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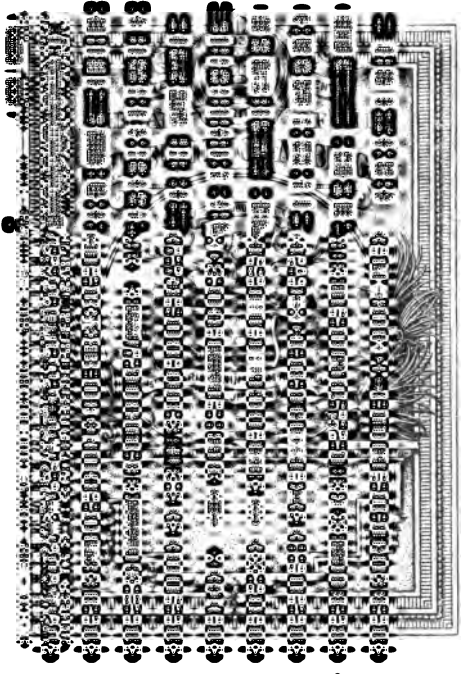
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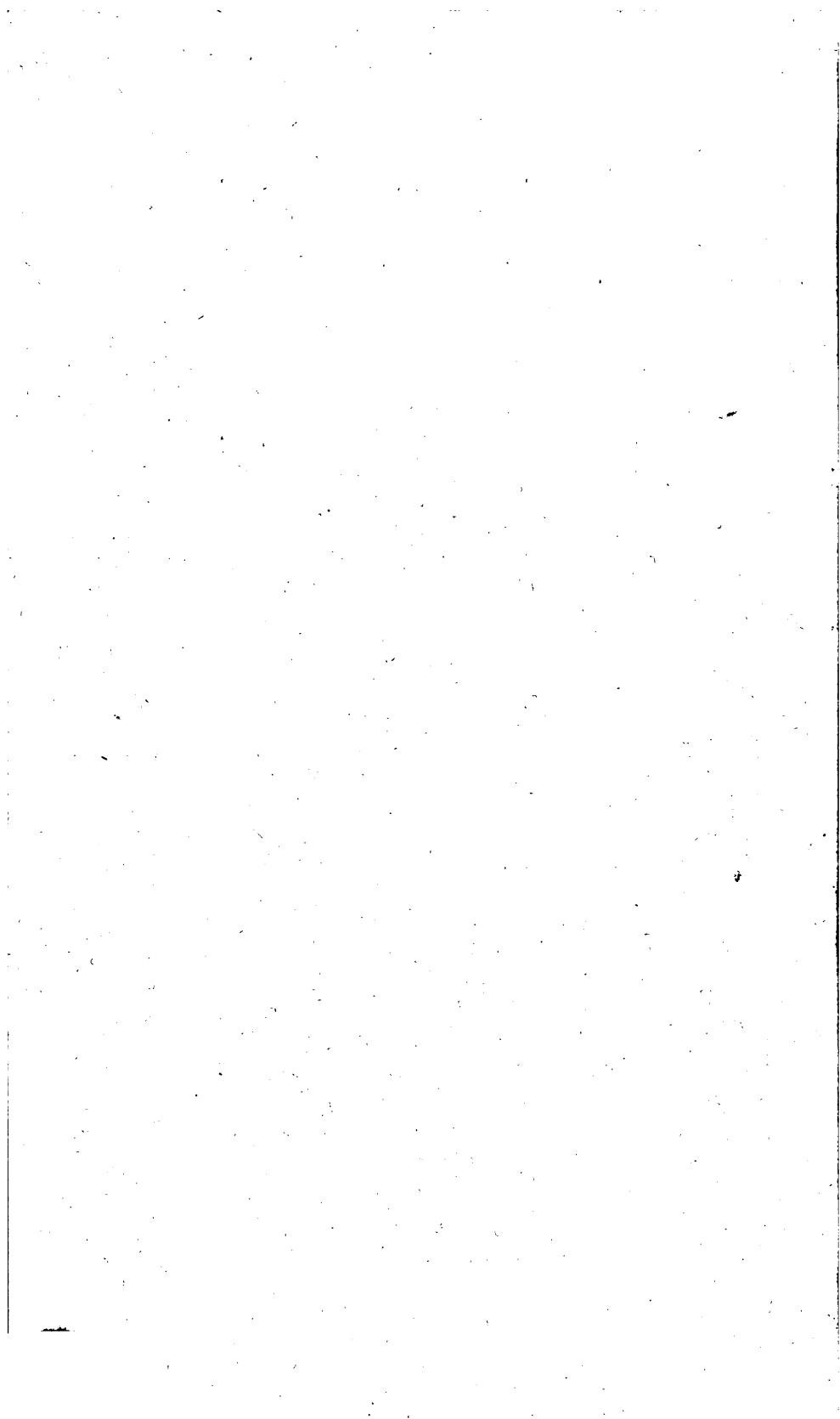
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bed of humus or the forest floor, which does more than any other part of the forest to retain and protect the water-supply, will not suffer at all in its water-conserving capacity, and the increased danger from fire which usually follows lumbering will not be incurred. Consequently the water-supply would not be unfavorably affected by its adoption.

In order to complete the protection that the forests of Township 40 afford to the upper watersheds of several important streams, it is essential that something be done toward regulating these streams. A beginning has been made in the construction of a small dam for maintaining the level of Raquette Lake. It is recommended in the working plan that this dam be replaced by a permanent structure, better adapted both for driving logs and for insuring a permanent water level in Raquette Lake. This level should be marked upon the proposed dam and should govern the official in charge in keeping the level of the lake at the right point. In the working plan the building of a new dam is fully discussed, and since the present level has come to be generally recognized as being the level best adapted to meet the varied interests at Raquette Lake, it has been accepted as practically established.

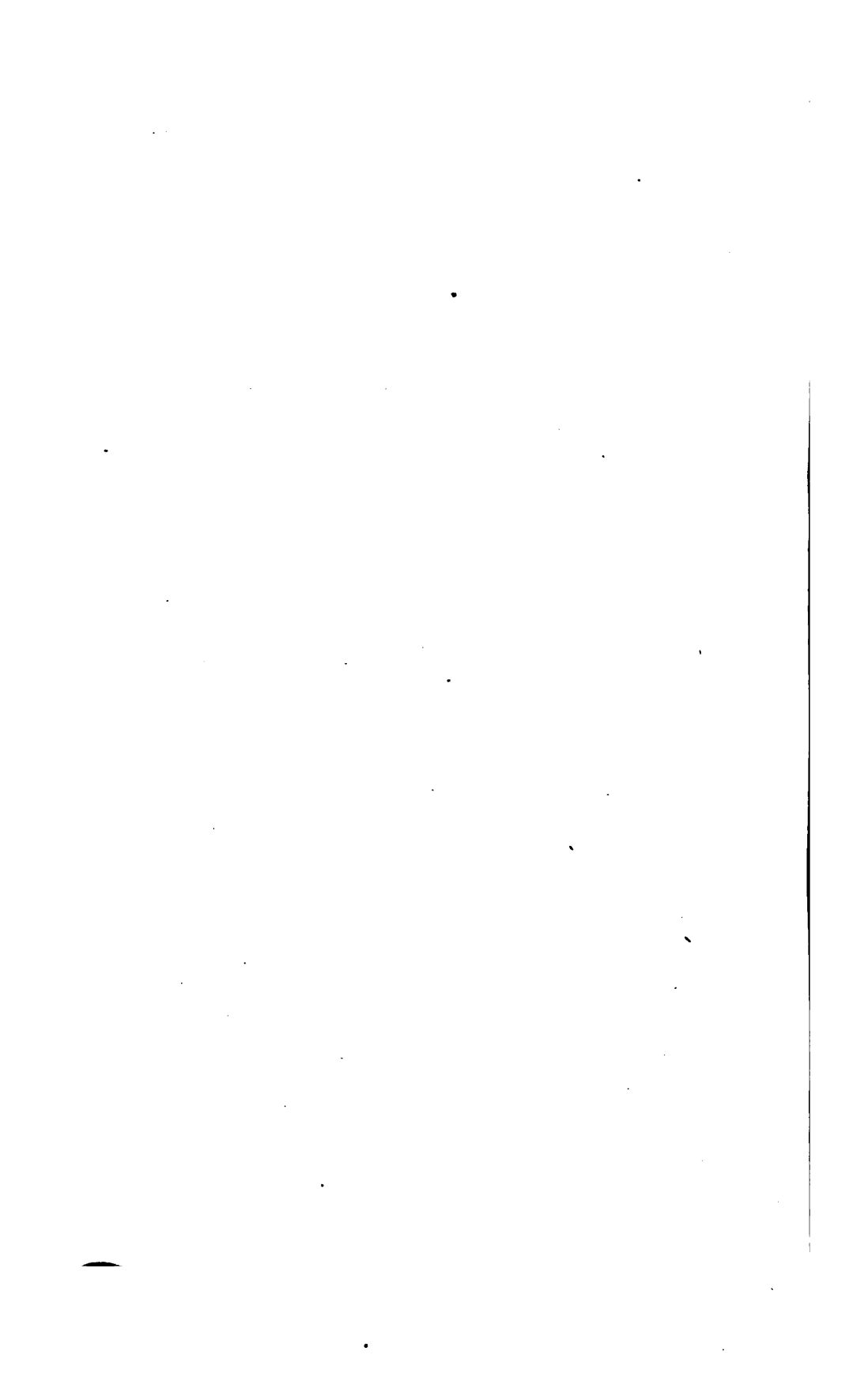
In the construction of the dam devices can be arranged at small cost by which accurate record and computation can be made of the daily flow, thus furnishing facts of great value in discussing the effect of forests on water conservation, and enabling those in charge to regulate the discharge of water from the lake in such way as to insure the best conditions for driving logs and for navigation. Systematic records made on different streams under varying conditions, and extending over a sufficient period to give trustworthy results, afford the most valuable source of information regarding stream flow. Records of this sort are especially needed at those points where the streams, though still in or near the forest, reach a large enough size to become important as feeders of the great rivers or as sources of power. At such points the influence of the forest on the watershed can best be studied, because fewer factors enter into the problem than lower down the stream. Comparison of watersheds generally similar in topography, but with different forest cover, as for example a forested area with one which has been heavily cut over, will yield results from which much may be learned.

There is great need of such records in order to discuss intelligently the effects of forest upon river flow, for while it is generally recognized that forest preservation has a beneficial influence, the extent of this influence has never been accurately determined, and there is wide diversity of opinion as to how far-reaching it is. On hardly any phase of forestry has there been more discussion than on this, and on hardly any is there so slight a basis of known fact on which to rest the argument. It is very necessary that a definite understanding be reached

on this point, for on the available supply of water depend many of the greatest industries of the country. Particularly is this true of New York State, where the canals and waterways play so large a part in the domestic commerce. Furthermore, it is eminently desirable that a definite understanding be reached of the fluctuation of streams which furnish power to mills or for navigation. The prospective manufacturer must know what to expect of a given stream before he will invest his capital in an undertaking dependent on it.

It is important to reduce these conclusions to a definite basis, expressed, if possible, in such form as to make it possible to estimate the actual value to the people or to the State of the better regulation of the stream. For instance, if it will cost a thousand dollars to preserve forest conditions upon a given tract, it is important to know whether the benefits thus derived will aggregate \$2,000 or only \$500. We can estimate the value of the timber, but the principal unknown factor is the valuation to be placed upon the improved condition of the streams. This valuation, as already said, can be reached only when a series of measurements have been made of the outflow from forest tracts and from similar areas which have been denuded.

Raquette Lake is the only body of water of considerable size in Township 40, but it is equally important to collect similar data at other lakes and ponds within the Adirondacks. One of the first steps in preparing to formulate a scheme of forest protection for the benefit of the water-supply should be a study of the uses of the water, and of how the flow should be regulated to make the benefit the largest possible. This work should be undertaken wherever practicable on the streams of the Adirondacks, and especially at such locations as the proposed dam at the outlet of Raquette Lake. These examinations, together with a thorough knowledge of the fluctuation of the lower streams and of the utilization of the water by mills or municipalities, will lead to a definite understanding of a highly important subject.



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A FOREST WORKING PLAN FOR TOWNSHIP 40, TOTTEN AND CROSSFIELD PURCHASE, HAMILTON COUNTY, N. Y.

SUMMARY.

The conclusions reached by the Division of Forestry of the United States Department of Agriculture after a thorough study of the forest problems of Township 40 are briefly summarized below. A detailed discussion of these conclusions follows in the working plan.

First. Under the systematic and conservative system of management advised in this working plan there would be no interference whatever with the value of the forest as a conserver of the water-supply. To this end ample reservations are recommended, which would thoroughly protect the watersheds and preserve the lake shores from damage. This statement as to watersheds and water-supply has been confirmed by Mr. F. H. Newell, Hydrographer of the United States Geological Survey, who, after personal examination of Township 40, has approved the recommendations made in this working plan. Particular attention would be given to the protection of the mountain summits and the natural beauties of Raquette Lake. Only the mature softwood timber would be cut, and that under close restrictions and constant supervision.

Second. Township 40 is a well-timbered township, on which there is a sufficiently heavy stand of mature Spruce to insure profitable lumbering under economical and conservative methods. There is also mature Pine and Balsam which should be cut.

Third. The topography of this township makes lumbering comparatively easy, since the greater part is tributary to Raquette Lake, which occupies the center of the township. The Raquette Lake Railway is at present the only means of getting the timber from Township 40 to the market. With the improvement of the river between Raquette and Forked lakes, which is strongly advised in this working plan, a second outlet would be secured for the timber on the greater part of Township 40, and also for all other timber tributary to Raquette Lake. The improvement of this river, so that logs might be driven from Raquette Lake, would make a material improvement in the bids submitted for the stumpage.

Fourth. Township 40 is covered by virgin forest. In a forest of this character the annual decay of the overmature trees offsets the annual growth. Each year many large trees die or are blown down and decay. These mature trees, if harvested, would yield a considerable revenue, and at the same time, the producing power of the forest being unimpaired, the conditions of growth would be improved. Under conservative lumbering successive crops may be cut from this forest at recurring intervals for an indefinite period.

Fifth. Under practical forestry this tract would yield a sustained revenue. By the adoption of a conservative and carefully devised system of lumbering, such as that advised in the working plan for

Township 40, the State would receive a sustained and increasing income from the Forest Preserve. This would bring about the right use of the forest resources of the State lands without in any way interfering with the objects for which the Forest Preserve was created, and without injury to its natural beauties.

From this statement it will be seen that the lumbering of the soft-wood timber under forest management is safe, practicable, and can be readily made profitable financially; that lumbering under the rules incorporated in the present working plan would tend to improve the condition of the forest, and increase its productive capacity; that such lumbering would remove overmature trees which by deterioration and decay offset the production of the forest in sound timber, and that all this may be accomplished wholly without interference with the water-supply or with any of the other objects of the Preserve.

The Division of Forestry therefore recommends that the necessary steps be taken to secure the lumbering of Township 40 by conservative methods.

Thorough supervision of the lumbering advised in this working plan for Township 40, by trained men, is essential to the improvement of the forest, to a sustained supply of timber, and to the preservation of the water-supply. Upon the efficiency of the supervision will depend the success of the results obtained by adopting this working plan.

INTRODUCTION.

The New York State Forest Preserve comprises an area of 1,370,928 acres, of which 1,290,987 are in the Adirondack Preserve and 79,941 in the Catskill Preserve. This large public reservation was set apart to "be forever reserved, maintained and cared for as ground open for the free use of all the people for their health and pleasure and as forest lands, necessary to the preservation of the head waters of the chief rivers of the State, and a future timber supply; and shall remain part of the forest preserve." For these purposes it was essential to preserve the forests; and so important was it considered to put them beyond the possibility of destruction that in 1894 an amendment to the constitution was adopted prohibiting absolutely the cutting or sale of any timber on land owned by the State within the Forest Preserve. Additions to the Preserve are made by the Forest Preserve Board. Its administration is in the hands of the Forest, Fish and Game Commission, whose engineer, the Superintendent of State Forests, has "charge of all work connected with the care and custody of the forest preserve."

Besides protecting the water-supply and furnishing a recreation ground, the Preserve is destined to become of great value to the people of the State as a permanent source of timber-supply. Far from being inconsistent with the other interests for which it is maintained, its conservative utilization for this purpose will rather advance them. Experience has shown that the great enemy of the forest is fire, not

lumbering. Forestry, the aim of which is to harvest successive crops, must protect and improve the forest. This it does by removing the mature trees in such a way that reproduction of the forest is secured and its continued productive existence is maintained. The trees which have passed their prime give place to a vigorous young growth, which, properly handled and protected, makes certain the future usefulness of the forest as a source of timber-supply. At the same time its beauty is unimpaired and its general condition improved.

Realizing the importance of a systematic and conservative plan for the management of the State forests along these lines, the Forest, Fish and Game Commission requested the cooperation of the United States Department of Agriculture in the study of the forest conditions of the Adirondack Preserve. The request was made in the face of the existing amendment to the constitution, adopted in 1894, which governs the Forest Preserve. This amendment reads as follows:

The lands of the State, now owned or hereafter acquired, constituting the forest Preserve as now fixed by law, shall be forever kept as wild forest lands. They shall not be leased, sold or exchanged, or be taken by any corporation, public or private, nor shall the timber thereon be sold, removed or destroyed.

It is understood that the main object of the Commission in making the request for the cooperation of the Department of Agriculture in the study of the Adirondack Preserve was to set before the people of the State the reasons why the above clause in the constitution should be so modified that the forest might be properly utilized and administered. These reasons are set forth in this working plan. The request was made under the terms of an offer by which the Department of Agriculture, through the Division of Forestry, offers to cooperate with owners in the preparation of working plans for forest lands which present favorable conditions for systematic and conservative management.¹

APPROPRIATION.

Under the timber-land agreement of the Division of Forestry, the salaries of the agents of the Division are paid by the Department of Agriculture, while the owner of the land pays their expenses for traveling and subsistence. To meet the initial expenses of the work requested by the Forest, Fish and Game Commission, the legislature of the State of New York during the session of 1900 appropriated \$2,000. This was to be expended by the Superintendent of State Forests "for the payment of the expenses of experts furnished by the United States Bureau of Forestry for estimating standing timber and other information regarding the lands and trees in the forest preserve."

It was decided by the Superintendent of State Forests and the Forester of the United States Department of Agriculture that the first

¹ Practical Assistance to Farmers, Lumbermen, and Others in Handling Forest Lands. Circular No. 21, Division of Forestry, United States Department of Agriculture, October, 1898.

working plan should be made for the tract known as Township 40, in Hamilton County, which contains Raquette Lake. Here, during the summer of 1900, the necessary field work was carried out by a party from the Division of Forestry, assisted by the three foresters of the Forest, Fish and Game Commission.

OBJECT OF THE WORKING PLAN.

The main purpose of this working plan is to outline a method of management under which the merchantable timber may be cut in such a manner that successive crops may be obtained and the condition of the forest constantly improved.

In order to decide how to make the first cutting so as to insure successive crops within a reasonable time and at a profit to the owner (in this case the State of New York), it is necessary to know the present stand of timber and of immature trees, and what the rate of growth of the latter will be after the mature trees have been removed. The making of the necessary measurements, with a thorough study of the habits and reproduction of the principal species, constitutes the chief field work incident to the preparation of the working plan, while the plan itself sets forth the advised method and manner of treatment.

In this study of a portion of the Adirondack Preserve, the intention has been to devise a system whereby the forest may be utilized without sacrificing the objects for which the Preserve is held.

In the preparation of a forest working plan the first step is necessarily a thorough study of the quality and amount of the merchantable timber and of transportation and market. A definite understanding of these things is necessary alike for the lumberman and for the forester. It is the basis on which each of them must form his judgment as to the amount of timber on the land, the diameter limit to which he may cut, the area to be logged over, and the probable profits to be obtained. Such a study of the whole situation is essential if the work is to be financially profitable.

There are, however, two points of view from which this situation may be regarded. The lumberman is primarily interested in the present crop and seeks the most profitable method of harvesting all the merchantable timber, with little or no thought for the future. The forester, on the other hand, is concerned not only with the profitable lumbering of the mature timber, but with lumbering it in such a way that the forest may be lumbered again and again. In these two points of view lies the radical difference between the lumberman and the forester.

The forest working plan is dependent on a knowledge of the future growth of the commercially important trees, for on the amounts which can be cut in the future, and on the time which must elapse before such cuts can be made depends in large measure what the present cut shall be, how much shall be lumbered, and how many years

must intervene between cuts. It is highly important that the figures on which these estimates are based should be accurate. To insure this, a very careful method of estimating standing timber has been adopted by the Division of Forestry, by which not only is the stand of merchantable timber found, but also the stand of the smaller trees from which the future harvests are to come. The method is explained in detail later (p. 21). The estimates of future yield are made by counting on felled trees the annual rings on the stump and at the top of each log, by careful diameter and height measurements, and by other means which aid in reading the life history of the trees. From a large number of these measurements tables are constructed, showing the number of years required by the trees to grow 1 inch in diameter on the stump. The present stand of small trees on a given area and their rate of growth being known, the future stand and yield may be predicted.

GENERAL DESCRIPTION OF TOWNSHIP 40.

Township 40 lies in what is known as the Totten and Crossfield Purchase. It is situated in the west central section of the Adirondack Park, in the northwest portion of Hamilton County, and forms part of the town of Long Lake. The situation of Township 40 in the Adirondack Park is shown on the frontispiece map. It forms, with adjoining State lands, one of the largest and most compact blocks of State land within the limits of the Park. Referring to Map I it will be seen that Township 40 is bounded wholly on two sides and partly on a third by State land, all of which is covered by virgin forest. On the east side, on the south half of Township 35, the State does not own the softwood timber, which was reserved when the tract was acquired.

The lines of Township 40, in common with those of other tracts in the Totten and Crossfield Purchase, run N. 63° E. and N. 27° W. These lines are known among the Adirondack surveyors as "10 and 2 o'clock lines," signifying that shadows would be thrown along the lines at the hours named. The lines running N. 63° E., which will be referred to as the north and south lines, are, approximately, 6 miles in length. The east and west lines are about 6½ miles. The total area is 25,660 acres.

The township is reached by the Raquette Lake Railway, the terminus of which is Durant, on the shores of Raquette Lake. This railroad makes track connection with the Adirondack branch of the New York Central and Hudson River Railroad at Clearwater, 19 miles from Durant, bringing Raquette Lake within 77 miles, by rail, of Utica on the main line.

A steamboat line on Raquette Lake connects Durant with Blue Mountain Lake, while another line to Long Lake via Forked Lake is projected. At Durant are ample wharves, where steamboats can

conveniently load, and a car float conveys loaded freight cars to Blue Mountain Lake or to a wharf at the lower end of Raquette Lake. (Pl. I, figs. 1 and 2.)

TOPOGRAPHY.

There are three watersheds on Township 40, the largest and most important containing Raquette Lake, which lies in the middle of the township. Raquette Lake is part of the Raquette River drainage system, and receives the waters of Blue Mountain Lake, one of the principal sources of the Raquette River, through Eagle Lake, Utowau Lake, and Marion River. The other important streams which flow into Raquette Lake are South and Browns Tract inlets and Sucker, Boulder, and Beaver brooks.

The waters of Raquette Lake flow into Forked Lake, thence through Long Lake into the Raquette River, and at last into the St. Lawrence. Its altitude is 1,762 feet above sea level.

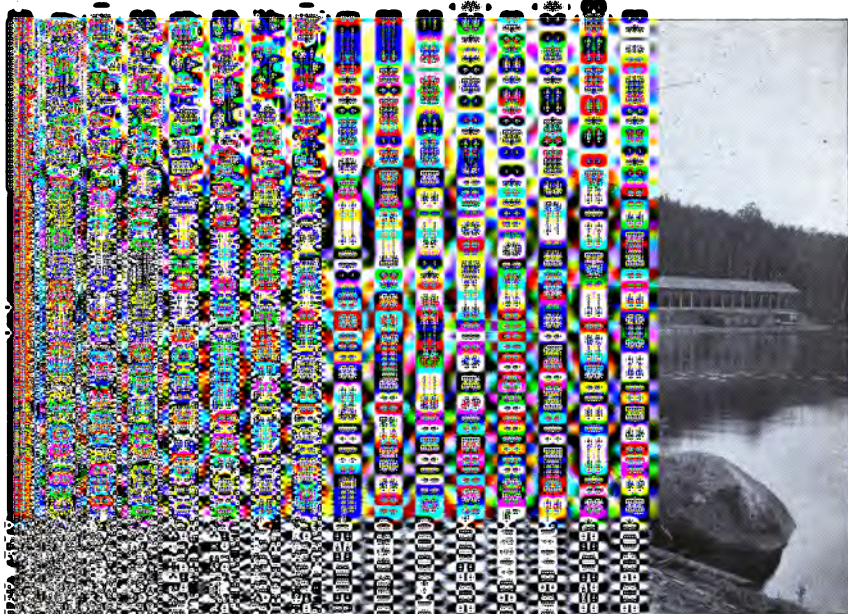
Of the two other watersheds on Township 40 one is formed by the low hills along the lake shore and the mountains north and west of the lake, which include Nigger Head and Pilgrim. This watershed is tributary to Forked Lake and Brandreth Lake Outlet. The latter flows across the northern part of the township from west to east and empties into an arm of Forked Lake extending into Township 40. (Pl. II, fig. 1.) This stream drains Brandreth Lake on Township 39, and is an important feature in the topography of Township 40.

The third watershed lies on the southwestern slopes of West Mountain, and drains into the Big Moose Lake system.

West Mountain is the highest point on the township; its altitude is 2,919 feet above the sea. (Pl. II, fig. 2.) Nigger Head and Pilgrim mountains are each a trifle over 2,800 feet. While the elevation of these mountains is not great, their steep sides and rugged summits give the township a distinctly mountainous character, which is the more noticeable from the absence of other peaks in the immediate vicinity. Between the lake and the higher mountains to the north and west the land is broken by hills. On the south side the mountains rise more abruptly, although they are not as high as those on the north and west sides. Along several of the inlets there is low swampy land and some open marsh, but in general the ground is elevated.

The prevailing rock is granite, often exposed on the mountains and along the lake front. Where mineral soil appears on the surface it is a sandy gravel of glacial origin; but for the most part the ground is covered by a deep layer of vegetable matter. This is replaced by muck in the swamps. There are several sandy beaches along the lake shore, but the banks are generally rocky and covered with trees to the water's edge.

Topographically, the dominant feature is Raquette Lake. Occupying the center of the township and with its many miles of shore line,



DURANT.

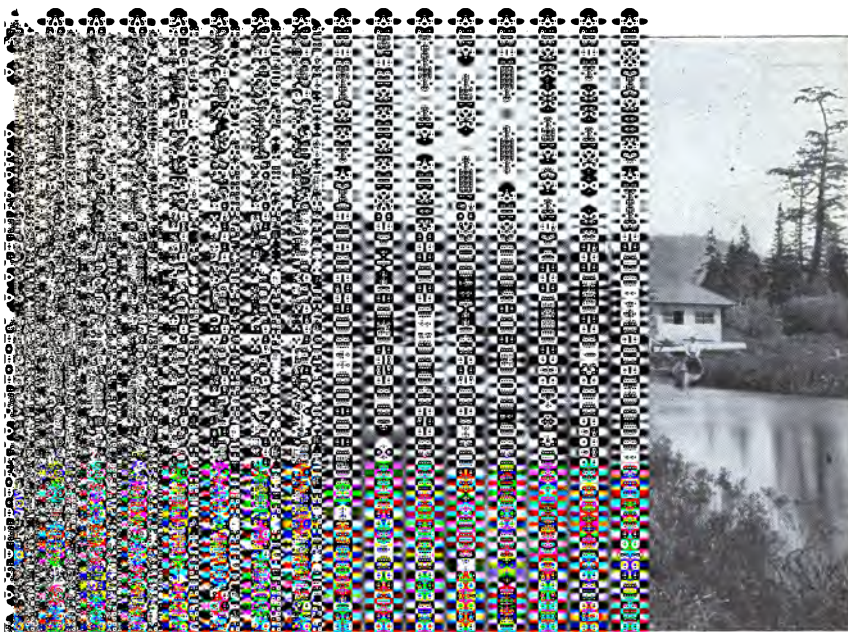
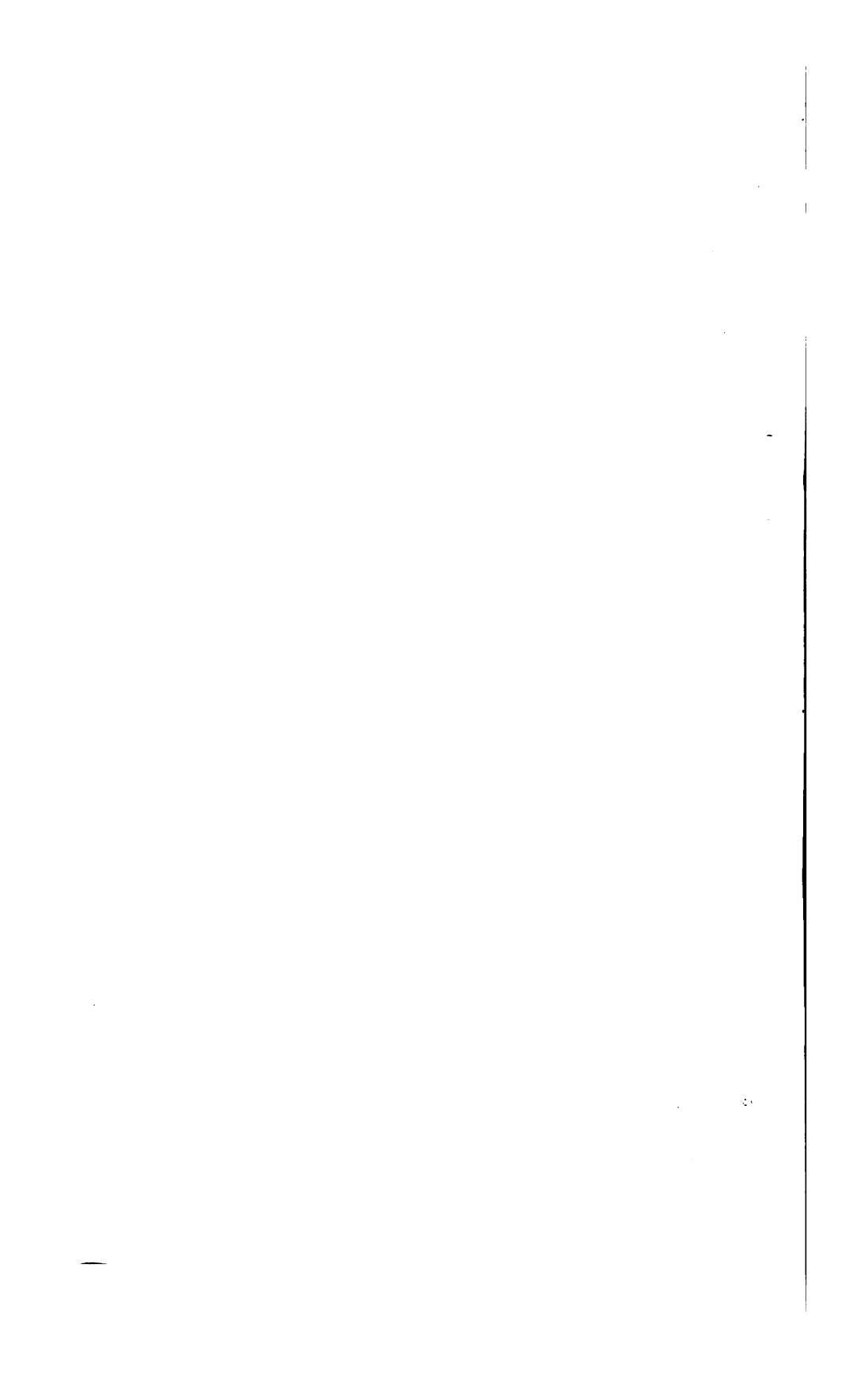
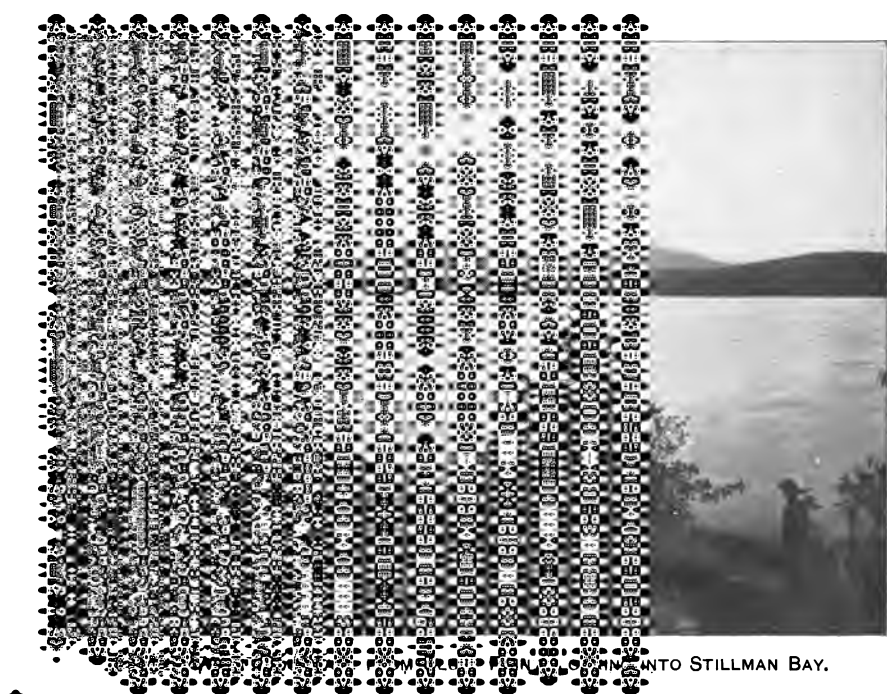
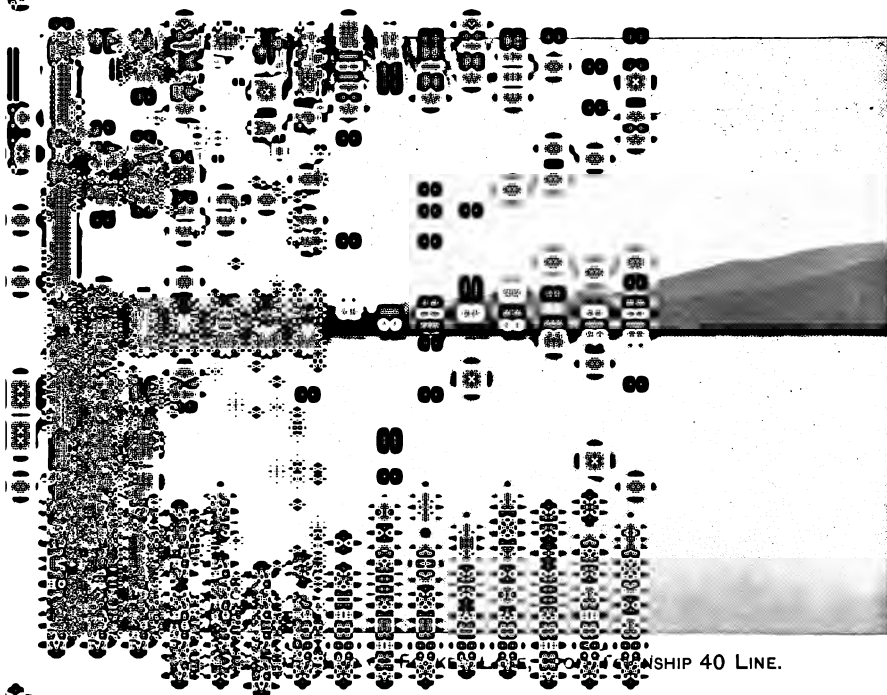
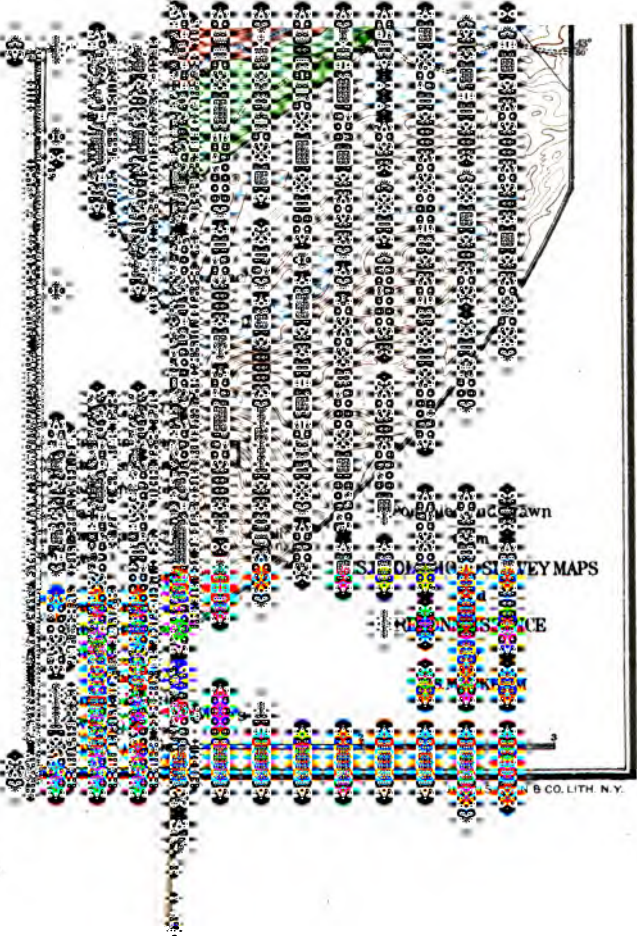
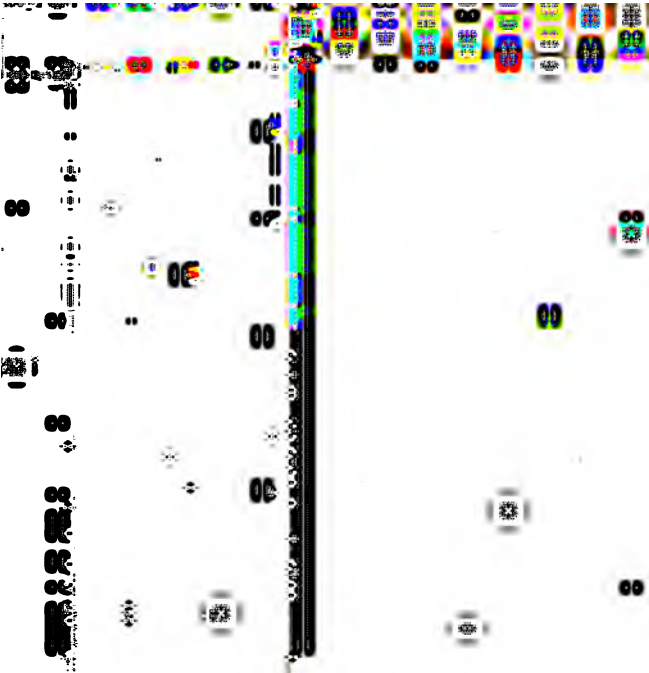


FIG. 1. CAR FLOAT WITH CAR.









broken by numerous points and large bays and by several picturesque islands, it gives character to the tract, and makes Township 40 one of the most interesting of the State's holdings.

THE FOREST.

The forest on Township 40, in common with that of the larger part of the Adirondack plateau, is a mixed forest of broadleaf (hardwood) and coniferous (softwood) trees, the latter predominating. The principal species are, in the order in which they occur: Spruce,¹ Yellow Birch, Balsam, Hemlock, Beech, Hard Maple, and White Pine. With these are associated *Arborvitæ*, commonly known as Cedar, Black Spruce, Tamarack, Red or Norway Pine, Soft Maple, and White Birch, with scattered White Ash and Black Cherry. Aspen, commonly known as Poplar, and Bird Cherry are found on the burned-over land. The underbrush is mainly Witch Hobble, Striped Maple or Moosewood, and Mountain or Spotted Maple.

Spruce so largely predominates on Township 40 that it makes this a characteristic Spruce township. This species forms 46 per cent of the trees in mixture.

FOREST TYPES.

In order to classify the forest and to make a more correct estimate of the standing timber, it is usual to recognize forest types. These depend largely on the situation, which to a considerable degree modifies the character of the forest, on the distribution of the various kinds of trees, and on their habits of growth.

On Township 40 the forest falls naturally into three principal types, which have been called Swamp, Spruce Land, and Upper Spruce Slope. The merchantable area of the forest (see Map II) contains only Swamp and Spruce Land. The area marked Summit Watershed Reserve on the maps is the Upper Spruce Slope land.

SWAMP.

The Swamp type includes the low-lying land along the main streams and inlets. It covers 1,977 acres, or 12 per cent of the merchantable area. In general, the elevation of the swamps is only slightly higher than that of the lake. Small areas of open marsh occur near the mouths of some of the streams, but most of the swamp land is covered by forest.

The characteristic species of the swamps are Spruce, Balsam, Cedar, Black Spruce, White Pine, and Tamarack. Within the swamps are found gravelly knolls, slightly elevated flats, and low ridges rising out of typical swamp land. On these occur White Pine and Hemlock in addition to Spruce, Balsam, and a few hardwoods.

On the lowest and most poorly drained land, immediately along the

¹ Wherever the word Spruce is used alone throughout this working plan it means the Red Spruce (*Picea rubens* Sargent).

streams, grow the Tamarack and Cedar. The Tamarack in the Adirondacks suffered very heavily several years ago from a sawfly worm, which destroyed nearly all of the large trees. A living mature Tamarack is now rare on Township 40. In addition, the continued annual flooding of the low ground bordering the inlets of Raquette Lake, caused by the dam which maintains the lake at a proper level for steamboat traffic, has killed practically all the young Tamarack as well as the Cedar growing on this ground.

It should be said here that the damage done by flooding is caused, not by the presence of very high water for a short time, but by holding the water above the normal level for considerable periods at a season of the year when tree growth is going on.

Cedar is also found scattered along the lake shores and bordering some of the brooks in the better drained Swamp and Spruce Land types. It reaches its best development in the latter situation, where the trees 10 inches and over at breastheight average 14 inches in diameter and 51 feet in height.

The Black Spruce found in the swamps is a small, spindling tree, of no commercial value. It is found on slightly higher ground than the Tamarack, and usually forms a pure stand. The Balsam is common in the dryer swamps, where trees 10 inches and over at breastheight average 11.1 inches in diameter and 63 feet high.

The White Pine in the forest of the Swamp type is limited to the gravelly knolls and low ridges. The Red Spruce is found on the better drained portions of Swamp, in mixture with the Balsam and Cedar, and on the ridges and low hills. While not reaching its best development, it is here of fair size and is the most important species in this type of forest as in all parts of the township.

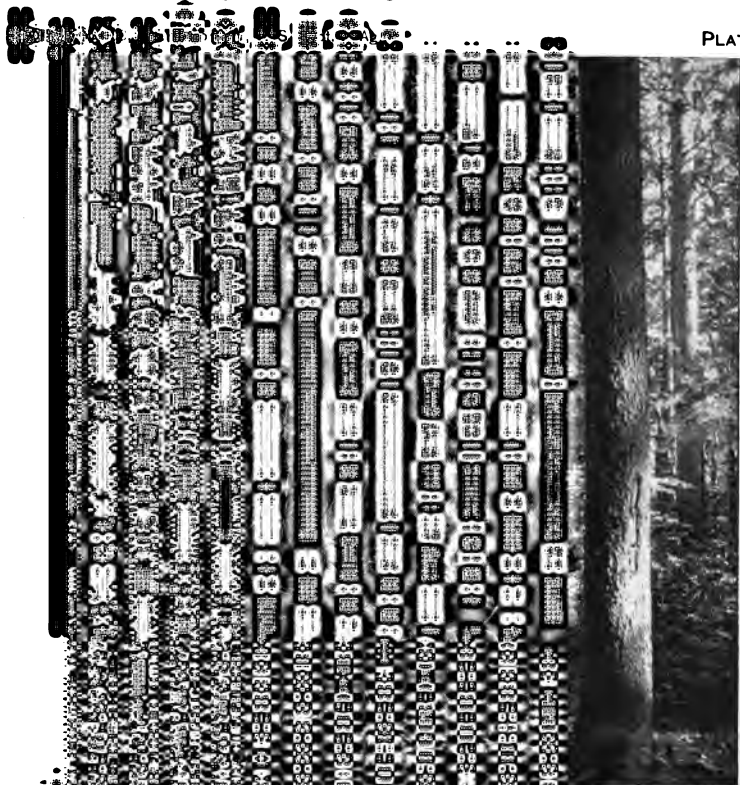
The following table was obtained by counting the trees and measuring their diameters on 90 sample acres in the Swamp type. It shows the average number of trees per acre, the average and maximum diameters of each species, and the percentage in mixture for all sound trees 10 inches and over in diameter breasthigh.

TABLE NO. 1.—*Swamp.*

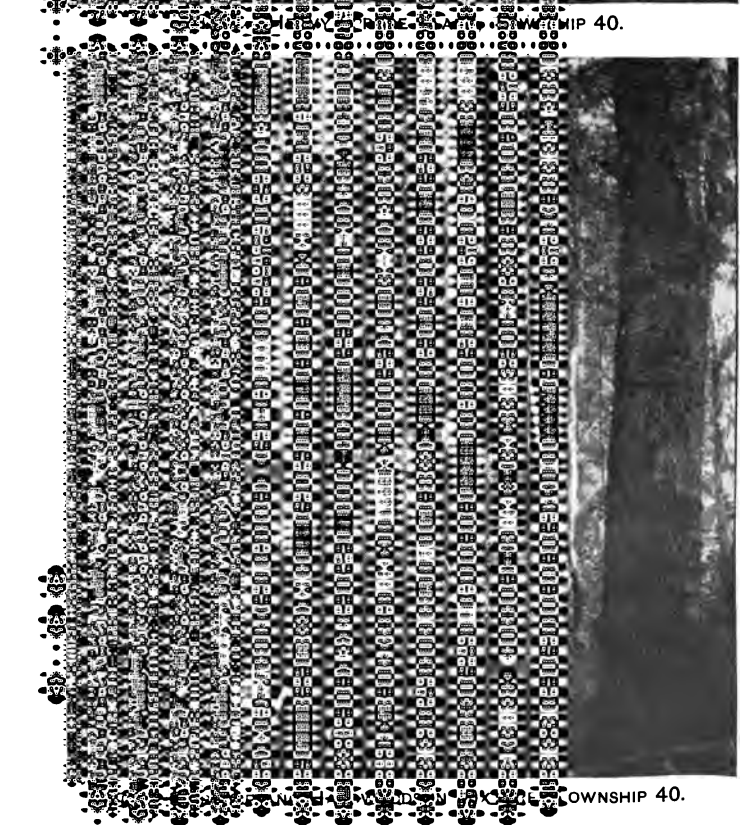
[Average of 90 acres.]

(Sound trees 10 inches and over in diameter breasthigh.)

| Name of species. | Average number of trees per acre. | Percentage of each species. | Average diameter breast-high. | Maximum diameter breast-high. |
|--|-----------------------------------|-----------------------------|-------------------------------|-------------------------------|
| | | | <i>Inches.</i> | <i>Inches.</i> |
| Spruce | 14.58 | 39.90 | 13.5 | 32 |
| Birch | 2.72 | 7.44 | 16.5 | 29 |
| Beech | .03 | .08 | 13.7 | 15 |
| Hard Maple | .31 | .84 | 14.5 | 20 |
| Hemlock | 1.94 | 5.30 | 15.0 | 27 |
| Balsam | 9.32 | 25.55 | 11.1 | 18 |
| Soft Maple | .29 | .79 | 17.5 | 20 |
| White Pine | 1.23 | 3.36 | 25.1 | 60 |
| Cedar | 5.68 | 15.54 | 13.3 | 25 |
| Other hardwoods | .44 | 1.20 | 13.6 | 21 |
| Average of all species | 36.54 | 100.00 | 13.6 | 25.7 |
| Average of all species except Spruce | 21.96 | 60.10 | 13.7 | 25 |



TRIP 40.



OWNSHIP 40.

SPRUCE LAND.

This type includes the larger part of Township 40. It covers 14,919 acres, or 88 per cent of the merchantable forest area. A general characteristic is that it is well drained; it embraces the rising ground and the lower mountain slopes. Red Spruce is the predominant species, making 47 per cent of the trees in mixture. The principal species associated with the Spruce are Yellow Birch, Balsam, Beech, Hemlock, Hard Maple, and White Pine.

The Spruce reaches its best individual development in mixture with the hardwoods on the lower slopes of the mountains. (Pl. III, figs. 1 and 2.) For the trees 10 inches and over in diameter at breastheight the average diameter is 14.2 inches and the average height 72 feet. The maximum diameter is 35 inches.

On this type the hardwoods attain good diameter and height and reach their highest percentage in the mixture. Balsam is more common on the lower portions of the Spruce Land and on the flats, but is found in mixture throughout the forest. (Pl. IV, fig. 1.) The Hemlock grows best on the lower slopes of the principal mountains, where it is found in mixture with Spruce and hardwoods. It shows a marked tendency to grow in groups. The White Pine on this type is found mainly along the lake shores, where it seeks the sandy banks, growing pure or mixed with the Red (Norway) Pine.

On the Spruce Land 953 acres were measured. A summary of the results obtained is given in the following table:

TABLE NO. 2.—*Spruce Land.*

(Average of 953 acres.)

(Sound trees 10 inches and over in diameter breasthigh.)

| Name of species. | Average number of trees per acre. | Percentage of each species. | Average diameter breast-high. | Maximum diameter breast-high. |
|--|-----------------------------------|-----------------------------|-------------------------------|-------------------------------|
| | | | <i>Inches.</i> | <i>Inches.</i> |
| Spruce | 24.23 | 46.17 | 14.2 | 35 |
| Birch | 8.98 | 17.11 | 19.0 | 42 |
| Beech | 4.70 | 8.95 | 15.8 | 30 |
| Hard Maple | 3.78 | 7.16 | 15.1 | 32 |
| Hemlock | 4.66 | 8.88 | 17.8 | 47 |
| Balsam | 4.82 | 9.18 | 11.4 | 24 |
| Soft Maple | .45 | .86 | 16.1 | 31 |
| White Pine | .40 | .76 | 26.5 | 49 |
| Cedar | .32 | .61 | 14.0 | 25 |
| Other hardwoods | .17 | .32 | 15.4 | 28 |
| Average of all species | 52.49 | 100.00 | 15.4 | 34.3 |
| Average of all species except Spruce | 28.26 | 53.83 | 16.4 | 34.2 |

UPPER SPRUCE SLOPE.

The third type, Upper Spruce Slope, has been made to include the summits and steep upper slopes of the chief mountains on the township. The lower limits of this type vary with locality, but seldom

extend below an elevation of 2,400 feet. This includes the summits of West, Pilgrim, and Nigger Head mountains and Bluff Point Hill.

Spruce predominates, with a subordinate mixture of Birch, Hard Maple, Beech, and Balsam. The trees in this type suffer from poor soil and exposure, and do not reach the height of those in more favorable and sheltered situations. They often become stunted toward the mountain tops. The following table gives the average of the 37 acres of Upper Spruce Slope measured:

TABLE NO. 3.—*Upper Spruce Slope.*

[Average of 37 acres.]

(Sound trees 10 inches and over in diameter breasthigh.)

| Name of species. | Average number of trees per acre. | Percentage of each species. | Average diameter breast-high. | Maximum diameter breast-high. |
|--|-----------------------------------|-----------------------------|-------------------------------|-------------------------------|
| | | | <i>Inches.</i> | <i>Inches.</i> |
| Spruce | 29.68 | 62.21 | 13.9 | 24 |
| Birch | 8.62 | 18.07 | 19.7 | 34 |
| Beech | 3.38 | 7.08 | 15.0 | 26 |
| Hard Maple | 4.38 | 9.18 | 17.4 | 28 |
| Hemlock | .62 | 1.30 | 17.7 | 30 |
| Balsam | .76 | 1.59 | 12.0 | 17 |
| Soft Maple | .19 | .40 | 15.4 | 18 |
| Other hardwoods | .08 | .17 | 14.5 | 17 |
| Average of all species | 47.71 | 100.00 | 15.4 | 24.5 |
| Average of all species except Spruce | 18.08 | 37.79 | 17.8 | 24.5 |

FIRE.

The forest on Township 40 has been unusually free from damage by fire. The burned areas, indicated on the maps by shading, are small in extent and in importance. The only burn of recent date is one of about 5 acres, which occurred during the summer of 1899. Mention of this burn is made in the Report of the Superintendent of State Forests to the Fisheries, Game and Forest Commission for that year.¹

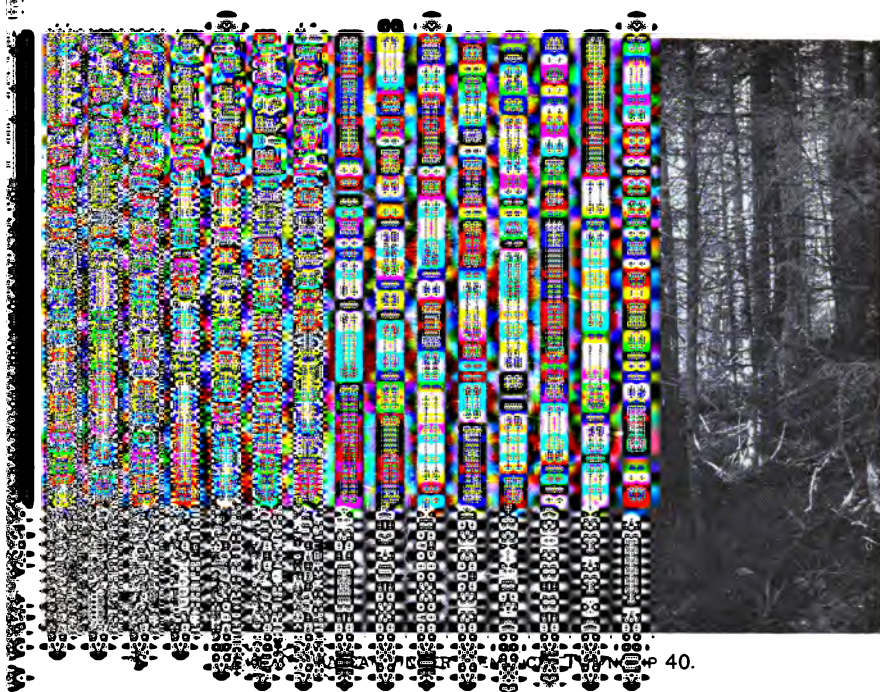
All the other burns on this township are old, dating back from twenty to fifty years. These old burns have largely grown up to White Birch, Cherry, and Aspen, followed by Spruce and hardwoods, which now form a vigorous young stand on these areas. (Pl. IV, fig. 2.) All told, the burns on the township form only 1 per cent of the forested area.

RESERVED AREAS.

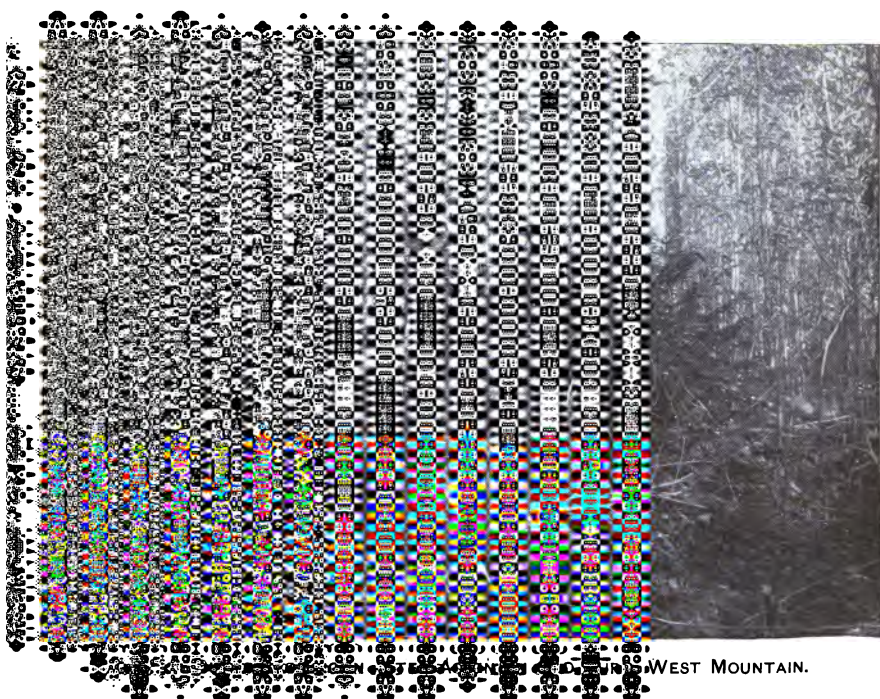
WATERSHED RESERVE.

One of the chief values of the Adirondack Preserve is in the preservation of the upper watersheds of important rivers. Nowhere is

¹ Preliminary Report to the Fifth Annual Report of the Commissioners of Fisheries, Game and Forest. Albany, 1900.



P. 40.



WEST MOUNTAIN.

this more important than on steep upper slopes where the soil and ground cover are in danger of being washed away unless protected by forest growth.

To protect these upper slopes it is recommended that the part of Township 40 which has been classed as Upper Spruce Slope should not be lumbered. On account of the heavy winds to which these mountain slopes are exposed, the forest might as well be cut clean if cut at all in lumbering such areas. If only a portion of the trees were removed, those left standing would be in great danger from wind on account of the increased exposure. If a clean cutting were made, a long time must elapse before another crop could be obtained, and reproduction is likely to be rendered difficult.

The timber on these upper slopes is of minor value, because the cost of lumbering it would so nearly equal the returns that the margin of profit would be exceedingly low. Another side of the question, and one which is of importance at Raquette Lake, is that a clean cutting on the steep slopes would seriously mar the beauty of the mountains as seen from the lake.

For these reasons it is strongly recommended that nothing be done in the forests on the upper slopes. These areas appear on Map II as "Summit Watershed Reserve."

WATER FRONT RESERVE.

In order to preserve the beauty of Raquette Lake another reserve is recommended, on which no cutting should be allowed. This consists of a belt along the shores of the lake and of Marion River. It has a minimum width of 200 feet, and is frequently much wider, as a glance at Map II will show. All the islands belonging to the State and several of the large points have been included, while at certain points also the belt widens inland, as, for example, along the north side of Marion River, where it is made to include the large pines which add so much to the beauty of that bank.

With a reserve along the whole water front the beauty of Raquette Lake would be unimpaired by lumbering. To a casual observer all traces of cutting would be completely hidden, for the logging roads cut through to the lake would be so located, as is explained later in this working plan, that no "slash" would be visible from any part of the lake.

Map II shows the three forest types referred to in the three preceding tables (the Upper Spruce Slope and the Summit Watershed Reserve being identical) and the Water Front Reserve. It shows also all the private holdings within Township 40, as given in the "List of lands belonging to the Forest Preserve, 1897," a report of the Superintendent of State Forests. These private holdings have been left uncolored.

MERCHANTABLE FOREST AREA.

The Spruce Land and the Swamp types combined made the merchantable forest area, and it is with this portion of the tract that the working plan has to deal. As already said, the total area of Township 40 is 25,660 acres. The following statement shows the area of the water surfaces, various reserves, burns, etc.:

| | Acres. |
|--|--------------|
| Raquette Lake and its islands, all streams, open marshes, and the Water Front Reserve..... | 7,288 |
| Private holdings..... | 766 |
| Summit Watershed Reserve and burned areas outside of reserves..... | 710 |
| Merchantable area— | |
| Spruce Land..... | 14,919 |
| Swamp..... | 1,977 |
| | <hr/> 16,896 |
| Total..... | <hr/> 25,660 |

The following table presents the average results obtained on the 1,043 sample acres included in the entire merchantable area:

TABLE NO. 4.—*Merchantable area—Spruce Land and Swamp combined.*

[Average of 1,043 acres.]

(Sound trees 10 inches and over in diameter breasthigh.)

| Name of species. | Average number of trees per acre. | Percent- age of each species. | Average diameter breast- high. | Maximum diameter breast- high. |
|--|-----------------------------------|-------------------------------|--------------------------------|--------------------------------|
| | | | <i>Inches.</i> | <i>Inches.</i> |
| Spruce | 23.40 | 45.75 | 14.0 | 35 |
| Birch | 8.44 | 16.50 | 19.0 | 42 |
| Beech | 4.30 | 8.41 | 15.3 | 30 |
| Hard Maple | 3.47 | 6.78 | 15.1 | 32 |
| Hemlock | 4.43 | 8.66 | 17.7 | 47 |
| Balsam | 5.21 | 10.19 | 11.4 | 24 |
| Soft Maple | .44 | .86 | 16.1 | 31 |
| White Pine | .48 | .94 | 25.6 | 60 |
| Cedar | .78 | 1.52 | 13.6 | 25 |
| Other hardwoods..... | .20 | .39 | 15.1 | 28 |
| Average of all species | 51.15 | 100.00 | 15.2 | 35.4 |
| Average of all species except Spruce | 27.75 | 54.25 | 16.2 | 35.4 |

THE ESTIMATE.

One of the most important steps in the preparation of a working plan is the measurement of standing timber and of the rate of growth of the more important trees. On these measurements are based tables giving the present stand and the future yield, and from them conclusions are drawn regarding the trees to be cut and the restrictions under which lumbering should be carried on. The method by which were obtained the necessary data on Township 40 for all the tables included in this working plan may now be described.

COMPARTMENTS.

To facilitate the estimate of standing timber, the township was divided into six compartments, depending on and following the natural divides. The advantage of a number of compartments of moderate size lies in the fact that the average acre more nearly represents the condition throughout the compartment than if the area were larger and more diversified in character. These compartments are shown by Roman numerals on Map III (p. 38). In dividing the township for lumbering purposes they fall naturally into three lumbering blocks, which, with the compartments, are fully described later in this working plan (p. 40).

VALUATION SURVEYS.

To estimate the standing timber on Township 40, valuation surveys were made. The object of a valuation survey is to ascertain the number of trees of the various kinds on sample acres, and their diameters. These sample acres are ordinarily strips one chain (66 feet) wide and 10 chains (660 feet) long. On Township 40 they were run on compass courses and so laid off at regular intervals and between definite points as thoroughly to gridiron it. They started from fixed stations about a quarter of a mile apart. Each survey party was made up of four men. Two carried the chain; one of these held the course and directed the party, while the other tallied the trees. A separate tally was kept for each acre. The other two men advanced to right and left of the chain, each measuring the diameter of the trees on his side within 33 feet of the chain. These measurements were obtained by calipers, and were taken at breastheight, or 4½ feet above the ground.

Red and Black Spruce and Balsam were calipered to 5 inches, and Pine, Hemlock, and the hardwoods to 10 inches, only sound trees being taken. One thousand and eighty valuation survey acres were measured on the township, distributed as follows among the forest types: Spruce Land, 953; Swamp, 90; Upper Spruce Slope, 37. Disregarding the Upper Spruce Slope, there are 1,043, so that for every 16 acres of merchantable forest land 1 acre has been measured.

Together with the valuation surveys, the height of the principal species was obtained by actual measurements with an instrument for that purpose known as Faustman's Hypsometer.

From the valuation surveys were obtained the number of trees per acre of the merchantable species, classified according to diameters by inches. From these diameter-classes the merchantable yield per acre was obtained by the use of tables constructed from actual scales of felled trees, giving the volumes which correspond to the various diameters at breastheight. In this way it was easy to calculate the

stand of each and of all merchantable species for each forest type, both on a given compartment and for the whole area.

VOLUME TABLES.

The contents of a tree of given diameter and height are got by the use of volume tables in conjunction with the valuation surveys. The tables have been prepared from measurements of numerous felled trees which have been carefully scaled. By counting on felled trees the annual rings of growth, and from other measurements, it has been possible to calculate their rate of growth in diameter and height and, consequently, in volume. Knowing the rate of growth of the timber trees and their number per acre as given by the surveys, the future yield after different periods and cutting to different diameter limits can be calculated.

In the preparation of the volume tables for this working plan, advantage was taken of lumbering which was in progress during 1900 on the Brandreth Preserve (Township 39), under the supervision of the Division of Forestry. Eleven hundred Spruce trees and 200 Hemlock were scaled. In calculating the contents of these Spruce in standards,¹ the trees were scaled to 6 inches in diameter at the small end. The advisability of this particular diameter limit will be discussed in detail later in this working plan (p. 56). As all stumps were cut low under the supervision of the Division of Forestry, it is believed that the volume table shows all that can be got from a tree of the given height and diameter. The volume was figured in standards by Dimick's Rule, the rule in common use in the Adirondacks.

The volume table for Balsam was obtained from a study of this species carried on by the Division of Forestry in the northern Adirondacks, the full results of which are to be published later.

The White Pine table was constructed from volume tables in "The White Pine,"² modified to accord with height and diameter measurements of the same species taken on Township 40. The volume tables for Yellow Birch, Hard Maple, and Beech were obtained from investigations of the Adirondack hardwoods made by the Division of Forestry in 1899. The hardwood volume tables are expressed in the Old Scribner Rule.

In calculating the merchantable volume of Cedar, the Spruce volume table was used, a reduction of 25 per cent being made on account of the difference in height and taper of the two species. The following table gives the contents on a basis of diameter at breastheight of all merchantable species, except Cedar, found on the township.

¹A standard is a log 13 feet long and 19 inches wide at the top end, containing approximately 195 feet B. M.

²"The White Pine," Pinchot and Graves. The Century Company, New York, 1896.

TABLE NO. 5.—*Merchantable contents per tree**For all marketable species except Cedar,**On a basis of diameter breasthigh.*

| Diameter breast- high. | Contents in standards by Dimick's Rule. | | | | Contents in board feet by Old Scribner Rule. | | |
|------------------------------|--|----------------|---------------|---------|---|----------------|--------|
| | Spruce. | White Pine. | Hem- lock. | Balsam. | Yellow Birch. | Hard Maple. | Beech. |
| <i>Inches.</i> | | | | | | | |
| 6 | 0.15 | ----- | ----- | 0.06 | ----- | ----- | ----- |
| 7 | .20 | ----- | ----- | .14 | ----- | ----- | ----- |
| 8 | .26 | ----- | ----- | .20 | ----- | ----- | ----- |
| 9 | .33 | ----- | 0.16 | .28 | ----- | ----- | ----- |
| 10 | .42 | 0.49 | .33 | .38 | ----- | ----- | ----- |
| 11 | .52 | .60 | .50 | .50 | ----- | ----- | ----- |
| 12 | .65 | .79 | .68 | .65 | ----- | ----- | ----- |
| 13 | .80 | .97 | .87 | .82 | ----- | ----- | ----- |
| 14 | .97 | 1.19 | 1.07 | 1.00 | ----- | ----- | ----- |
| 15 | 1.15 | 1.46 | 1.28 | 1.21 | 121 | 126 | 128 |
| 16 | 1.35 | 1.73 | 1.50 | 1.43 | 134 | 152 | 141 |
| 17 | 1.56 | 2.06 | 1.74 | 1.66 | 153 | 180 | 166 |
| 18 | 1.79 | 2.41 | 1.99 | ----- | 180 | 210 | 204 |
| 19 | 2.03 | 2.77 | 2.26 | ----- | 211 | 242 | 252 |
| 20 | 2.29 | 3.14 | 2.55 | ----- | 249 | 276 | 306 |
| 21 | 2.58 | 3.55 | 2.87 | ----- | 285 | 310 | 362 |
| 22 | 2.89 | 3.96 | 3.21 | ----- | 322 | 345 | 420 |
| 23 | 3.23 | 4.41 | 3.56 | ----- | 359 | 382 | 479 |
| 24 | 3.60 | 4.89 | 3.98 | ----- | 398 | 424 | 543 |
| 25 | 3.98 | 5.37 | 4.33 | ----- | 435 | 474 | 608 |
| 26 | 4.40 | 5.85 | 4.77 | ----- | 474 | 534 | 678 |
| 27 | 4.86 | 6.35 | 5.23 | ----- | 518 | 596 | ----- |
| 28 | 5.36 | 6.89 | 5.70 | ----- | 564 | 670 | ----- |
| 29 | 5.90 | 7.46 | 6.20 | ----- | 608 | 758 | ----- |
| 30 | 6.48 | 8.03 | 6.72 | ----- | 658 | ----- | ----- |
| 31 | ----- | 8.68 | 7.26 | ----- | 704 | ----- | ----- |
| 32 | ----- | 9.31 | ----- | ----- | 757 | ----- | ----- |
| 33 | ----- | 9.93 | ----- | ----- | 810 | ----- | ----- |
| 34 | ----- | 10.59 | ----- | ----- | 866 | ----- | ----- |
| 35 | ----- | 11.28 | ----- | ----- | ----- | ----- | ----- |
| 36 | ----- | 12.06 | ----- | ----- | ----- | ----- | ----- |
| 37 | ----- | 12.74 | ----- | ----- | ----- | ----- | ----- |
| 38 | ----- | 13.64 | ----- | ----- | ----- | ----- | ----- |
| 39 | ----- | 14.54 | ----- | ----- | ----- | ----- | ----- |
| 40 | ----- | 15.44 | ----- | ----- | ----- | ----- | ----- |

YIELD TABLES.

PRESENT STAND.

The following tables show the present stand or merchantable timber for the eight commercial trees growing on Township 40. They were compiled from the 1,043 acres of valuation surveys already mentioned and explained. In these tables the total stand for each compartment was found by multiplying the average stand got from the surveys by the number of acres in the compartment. The average stand was carried out to four decimal places and then multiplied by the acreage. In order, however, to simplify and shorten the table, two of these decimal places were taken off in the final figures, both for the total stand and the average stand per acre. This explains the fact that the product of the average stand multiplied by the total number of acres in the compartment varies slightly from the product as stated in the table. This variation is so small as to have no appreciable effect on the result.

The following table gives in standards by Dimick's Rule the present stand of Spruce on Township 40, to limits of 10, 12, and 14 inches at breastheight. The table shows also the total stand and the average

stand per acre on each compartment for Spruce Land and Swamp, separately and combined.

TABLE NO. 6.—*Spruce—Present stand.*

[Merchantable volume in standards by Dimick's Rule.]

| Number of compartment. | Type. | Acres. | Cutting to a limit of 10 inches in diameter breasthigh. | | Cutting to a limit of 12 inches in diameter breasthigh. | | Cutting to a limit of 14 inches in diameter breasthigh. | |
|------------------------|-------------------------------------|--------|---|--------------|---|--------------|---|--------------|
| | | | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. |
| I..... | Spruce Land..... | 3,743 | 23.77 | 107,683.12 | 24.33 | 91,078.88 | 19.19 | 71,813.64 |
| II..... | do..... | 621 | 26.17 | 16,252.21 | 23.59 | 14,648.89 | 19.50 | 12,109.09 |
| III..... | do..... | 2,224 | 21.23 | 47,212.66 | 18.43 | 40,994.31 | 14.89 | 33,105.95 |
| IV..... | do..... | 2,678 | 20.47 | 54,811.93 | 17.13 | 45,878.48 | 13.79 | 38,942.74 |
| V..... | do..... | 4,798 | 23.14 | 111,001.81 | 19.51 | 93,590.42 | 15.81 | 75,876.60 |
| VI..... | do..... | 855 | 27.69 | 23,675.60 | 24.23 | 20,718.79 | 19.68 | 16,826.40 |
| Total..... | | 14,919 | 24.17 | 360,637.33 | 20.57 | 306,907.77 | 16.53 | 246,675.02 |
| I..... | Swamp..... | 685 | 14.76 | 10,110.60 | 11.47 | 7,856.95 | 8.33 | 5,706.05 |
| II..... | do..... | 12 | 11.88 | 142.56 | 8.80 | 105.60 | 6.62 | 79.44 |
| III..... | do..... | 252 | 9.51 | 2,396.52 | 7.44 | 1,874.88 | 5.79 | 1,459.06 |
| IV..... | do..... | 595 | 13.60 | 8,092.00 | 11.03 | 6,562.85 | 8.43 | 5,015.35 |
| V..... | do..... | 433 | 14.36 | 6,217.88 | 11.60 | 4,979.50 | 9.28 | 4,018.24 |
| Total..... | | 1,977 | 13.64 | 26,959.56 | 10.81 | 21,379.78 | 8.23 | 16,278.66 |
| I..... | Spruce Land and Swamp combined..... | 4,428 | 26.60 | 117,793.72 | 22.34 | 98,935.83 | 17.51 | 77,519.69 |
| II..... | do..... | 633 | 25.90 | 16,394.77 | 23.31 | 14,752.49 | 19.26 | 12,189.13 |
| III..... | do..... | 2,476 | 20.04 | 49,609.18 | 17.31 | 42,860.19 | 13.96 | 34,565.03 |
| IV..... | do..... | 3,273 | 19.22 | 62,903.93 | 16.02 | 52,441.33 | 12.82 | 41,956.59 |
| V..... | do..... | 5,231 | 22.41 | 117,219.69 | 18.84 | 98,590.92 | 15.27 | 79,894.64 |
| VI..... | do..... | 855 | 27.69 | 23,675.60 | 24.23 | 20,718.79 | 19.68 | 16,826.40 |
| Total..... | | 16,896 | 22.94 | 387,596.89 | 19.43 | 328,287.55 | 15.56 | 262,953.68 |

The following table gives in standards by Dimick's Rule the present stand of Balsam on Township 40, to limits of 10, 12, and 14 inches in diameter breasthigh. The table shows, also, the total stand and the average stand per acre on each compartment for Spruce Land and Swamp, separately and combined.

TABLE NO. 7.—*Balsam—Present stand.*

[Merchantable volume in standards by Dimick's Rule.]

| Number of compartment. | Type. | Acres. | Cutting to a limit of 10 inches in diameter breasthigh. | | Cutting to a limit of 12 inches in diameter breasthigh. | | Cutting to a limit of 14 inches in diameter breasthigh. | |
|------------------------|------------------|--------|---|--------------|---|--------------|---|--------------|
| | | | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. |
| I..... | Spruce Land..... | 3,743 | 2.32 | 8,684.51 | 1.10 | 4,111.31 | 0.40 | 1,481.11 |
| II..... | do..... | 621 | 1.06 | 655.96 | .50 | 311.31 | .20 | 126.13 |
| III..... | do..... | 2,224 | 3.49 | 7,759.09 | 1.84 | 4,102.39 | .69 | 1,537.45 |
| IV..... | do..... | 2,678 | 4.42 | 11,845.87 | 2.35 | 6,282.05 | .88 | 2,363.87 |
| V..... | do..... | 4,798 | 2.65 | 12,730.05 | 1.46 | 6,981.09 | .66 | 3,184.91 |
| VI..... | do..... | 855 | 1.96 | 1,672.81 | 1.18 | 1,012.75 | .40 | 344.22 |
| Total..... | | 14,919 | 2.91 | 43,348.29 | 1.53 | 22,800.90 | .61 | 9,037.69 |

TABLE NO. 7.—*Balsam—Present stand—Continued.*

| Number of compartment. | Type. | Acres. | Cutting to a limit of 10 inches in diameter breasthigh. | | Cutting to a limit of 12 inches in diameter breasthigh. | | Cutting to a limit of 14 inches in diameter breasthigh. | |
|------------------------|-------------------------------------|--------|---|--------------|---|--------------|---|--------------|
| | | | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. |
| I..... | Swamp..... | 685 | 6.25 | 4,284.54 | 2.35 | 1,608.11 | .83 | 568.00 |
| II..... | do..... | 12 | .79 | 9.48 | .41 | 4.92 | .41 | 4.92 |
| III..... | do..... | 252 | 2.46 | 620.42 | 1.38 | 347.00 | .77 | 192.78 |
| IV..... | do..... | 595 | 5.05 | 3,003.86 | 2.49 | 1,479.59 | .70 | 413.70 |
| V..... | do..... | 433 | 6.12 | 2,651.52 | 2.48 | 1,075.40 | .57 | 245.08 |
| Total..... | | 1,977 | 5.35 | 10,569.82 | 2.28 | 4,515.02 | .72 | 1,424.48 |
| I..... | Spruce Land and Swamp combined..... | 4,428 | 2.93 | 12,969.05 | 1.29 | 5,719.42 | .46 | 2,049.11 |
| II..... | do..... | 633 | 1.05 | 665.44 | .50 | 316.23 | .21 | 131.05 |
| III..... | do..... | 2,476 | 3.38 | 8,379.51 | 1.80 | 4,449.39 | .70 | 1,790.23 |
| IV..... | do..... | 3,273 | 4.54 | 14,849.73 | 2.37 | 7,761.64 | .85 | 2,777.57 |
| V..... | do..... | 5,231 | 2.94 | 15,381.57 | 1.54 | 8,056.49 | .66 | 3,429.99 |
| VI..... | do..... | 855 | 1.96 | 1,672.81 | 1.18 | 1,012.75 | .40 | 344.22 |
| Total..... | | 16,896 | 3.19 | 53,918.11 | 1.62 | 27,815.92 | .62 | 10,462.17 |

The following table gives in standards by Dimick's Rule the present stand of small Balsam from 6 to 9 inches, inclusive, in diameter breasthigh. The table shows also the total stand and the average stand per acre on each compartment for Spruce Land and Swamp, separately and combined.

TABLE NO. 8.—*Small Balsam—Present stand.*

[Merchantable volume in standards by Dimick's Rule of trees 6 to 9 inches, inclusive, in diameter breasthigh.]

| Number of compartment. | Type. | Acres. | Average stand per acre. | Total stand. |
|------------------------|-------------------------------------|--------|-------------------------|--------------|
| I..... | Spruce Land..... | 3,743 | 1.91 | 7,164.10 |
| II..... | do..... | 621 | .91 | 566.23 |
| III..... | do..... | 2,224 | 3.14 | 6,982.47 |
| IV..... | do..... | 2,678 | 3.36 | 9,008.79 |
| V..... | do..... | 4,798 | 1.70 | 8,155.24 |
| VI..... | do..... | 855 | 1.03 | 884.58 |
| Total..... | | 14,919 | 2.20 | 32,771.41 |
| I..... | Swamp..... | 685 | 9.05 | 6,199.52 |
| II..... | do..... | 12 | 2.81 | 33.72 |
| III..... | do..... | 252 | 5.98 | 1,505.95 |
| IV..... | do..... | 595 | 6.74 | 4,008.52 |
| V..... | do..... | 433 | 6.54 | 2,832.17 |
| Total..... | | 1,977 | 7.37 | 14,579.88 |
| I..... | Spruce Land and Swamp combined..... | 4,428 | 3.02 | 13,363.62 |
| II..... | do..... | 633 | .95 | 599.95 |
| III..... | do..... | 2,476 | 3.43 | 8,488.42 |
| IV..... | do..... | 3,273 | 3.98 | 13,017.31 |
| V..... | do..... | 5,231 | 2.10 | 10,997.41 |
| VI..... | do..... | 855 | 1.03 | 884.58 |
| Total..... | | 16,896 | 2.80 | 47,351.29 |

The following table gives in standards by Dimick's Rule the present stand of Pine on Township 40, to limits of 10, 12, and 14 inches in diameter breasthigh. In this table "Pine Land" includes that portion of each compartment upon which the stand of Pine is heavy

| | | Cutting to limit of 12 inches in diameter breasting. | | Cutting to limit of 12 inches in diameter breasting. | | | | |
|-------|--|---|----------------|---|----------------|----------|------|----------|
| | | Average stand per acre | Total stand | Average stand per acre. | Total stand | | | |
| I | Swamp | 1.14 | 1.14 | 34.2 | 1.14 | 42.3 | 0.64 | 34.5 |
| II | do | 1.14 | 1.14 | 34.2 | 1.14 | 37.8 | 0.37 | 16.8 |
| III | do | 1.14 | 1.14 | 34.2 | 1.14 | 37.8 | 0.37 | 16.8 |
| IV | do | 1.14 | 1.14 | 34.2 | 1.14 | 37.8 | 0.37 | 16.8 |
| V | do | 1.14 | 1.14 | 34.2 | 1.14 | 37.8 | 0.37 | 16.8 |
| VI | do | 1.14 | 1.14 | 34.2 | 1.14 | 37.8 | 0.37 | 16.8 |
| Total | | 6.5 | 6.5 | 34.2 | 6.5 | 223.2 | 0.46 | 223.2 |
| Total | | 14.94 | 1.2 | 1,776.72 | 1.2 | 2,389.08 | 1.7 | 2,576.0 |
| I | Swamp | 0.4 | 0.4 | 102.4 | 0.4 | 40.96 | 0.08 | 32.0 |
| II | do | 0.4 | 0.4 | 102.4 | 0.4 | 40.96 | 0.08 | 32.0 |
| III | do | 0.4 | 0.4 | 102.4 | 0.4 | 40.96 | 0.08 | 32.0 |
| IV | do | 0.4 | 0.4 | 102.4 | 0.4 | 40.96 | 0.08 | 32.0 |
| V | do | 0.4 | 0.4 | 102.4 | 0.4 | 40.96 | 0.08 | 32.0 |
| VI | do | 0.4 | 0.4 | 102.4 | 0.4 | 40.96 | 0.08 | 32.0 |
| Total | | 2.4 | 2.4 | 768.0 | 2.4 | 163.84 | 0.32 | 163.84 |
| Total | | 1.84 | 1.45 | 4,811.44 | 1.45 | 5,476.0 | 1.97 | 3,889.14 |
| I | Spruce Land and Swamp com- bined | 4.42 | 1.36 | 795.84 | 1.36 | 355.02 | 0.07 | 327.90 |
| II | do | 4.42 | 1.36 | 795.84 | 1.36 | 355.02 | 0.07 | 327.90 |
| III | do | 4.42 | 1.36 | 795.84 | 1.36 | 355.02 | 0.07 | 327.90 |
| IV | do | 4.42 | 1.36 | 795.84 | 1.36 | 355.02 | 0.07 | 327.90 |
| V | do | 4.42 | 1.36 | 795.84 | 1.36 | 355.02 | 0.07 | 327.90 |
| VI | do | 4.42 | 1.36 | 795.84 | 1.36 | 355.02 | 0.07 | 327.90 |
| Total | | 16.86 | 1.63 | 10,562.79 | 1.63 | 8,777.10 | 1.38 | 6,450.33 |

The following table gives in standards by Dimick's Rule the present
 on Township 40 to limits of 10, 12, and 14 inches

in diameter breasthigh. The table shows also the total stand and the average stand per acre on each compartment for Spruce Land and Swamp, separately and combined.

TABLE NO. 11.—*Hemlock—Present stand.*

[Merchantable volume in standards by Dimick's Rule.]

| Number of compartment. | Type. | Acres. | Cutting to a limit of 10 inches in diameter breasthigh. | | Cutting to a limit of 12 inches in diameter breasthigh. | | Cutting to a limit of 14 inches in diameter breasthigh. | |
|------------------------|-------------------------------------|--------|---|--------------|---|--------------|---|--------------|
| | | | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. |
| I..... | Spruce Land..... | 3,743 | 5.74 | 21,475.84 | 5.54 | 20,730.98 | 5.24 | 19,596.85 |
| II..... | do..... | 621 | 18.36 | 11,399.95 | 17.86 | 11,090.56 | 16.74 | 10,396.15 |
| III..... | do..... | 2,224 | 7.80 | 17,355.65 | 7.51 | 16,685.12 | 6.94 | 15,432.34 |
| IV..... | do..... | 2,678 | 15.95 | 42,707.41 | 15.46 | 41,396.52 | 14.61 | 39,122.37 |
| V..... | do..... | 4,798 | 10.32 | 49,502.89 | 9.85 | 47,256.94 | 9.14 | 43,872.43 |
| VI..... | do..... | 855 | 2.59 | 2,215.31 | 2.55 | 2,178.37 | 2.39 | 2,040.71 |
| Total..... | | 14,919 | 9.69 | 144,657.05 | 9.34 | 139,348.49 | 8.74 | 130,462.85 |
| I..... | Swamp..... | 685 | .52 | 354.00 | .45 | 311.27 | .38 | 259.75 |
| II..... | do..... | 12 | 7.42 | 89.04 | 6.01 | 72.06 | 4.89 | 58.68 |
| III..... | do..... | 252 | 1.08 | 271.78 | 1.04 | 261.32 | .66 | 165.06 |
| IV..... | do..... | 595 | 4.09 | 2,453.43 | 3.77 | 2,240.18 | 3.26 | 1,937.44 |
| V..... | do..... | 453 | 3.98 | 1,721.78 | 3.70 | 1,601.06 | 3.19 | 1,379.71 |
| Total..... | | 1,977 | 2.46 | 4,870.03 | 2.27 | 4,485.89 | 1.92 | 3,800.64 |
| I..... | Spruce Land and Swamp combined..... | 4,428 | 4.93 | 21,829.84 | 4.75 | 21,042.25 | 4.48 | 19,856.60 |
| II..... | do..... | 633 | 18.15 | 11,488.99 | 17.63 | 11,162.62 | 16.52 | 10,456.83 |
| III..... | do..... | 2,476 | 7.12 | 17,627.43 | 6.85 | 16,956.44 | 6.30 | 15,597.40 |
| IV..... | do..... | 3,278 | 13.79 | 45,140.84 | 13.33 | 43,636.70 | 12.55 | 41,059.51 |
| V..... | do..... | 5,231 | 9.79 | 51,224.67 | 9.34 | 48,858.00 | 8.65 | 45,252.14 |
| VI..... | do..... | 855 | 2.59 | 2,215.31 | 2.55 | 2,178.37 | 2.39 | 2,040.71 |
| Total..... | | 16,896 | 8.85 | 149,527.08 | 8.51 | 143,834.38 | 7.94 | 134,263.49 |

The following table gives in board feet by Old Scribner Rule the present stand of Birch on Township 40, to limits of 15, 17, and 19 inches in diameter breasthigh. The table shows also the total stand and the average stand per acre on each compartment for Spruce Land and Swamp, separately and combined.

TABLE NO. 12.—*Birch—Present stand.*

[Merchantable volume in board-feet by Old Scribner Rule.]

| Number of compartment. | Type. | Acres. | Cutting to a limit of 15 inches in diameter breasthigh. | | Cutting to a limit of 17 inches in diameter breasthigh. | | Cutting to a limit of 19 inches in diameter breasthigh. | |
|------------------------|------------------|--------|---|--------------|---|--------------|---|--------------|
| | | | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. |
| I..... | Spruce Land..... | 3,743 | 1,964 | 7,350,810 | 1,722 | 6,447,179 | 918 | 3,437,243 |
| II..... | do..... | 621 | 2,118 | 1,315,105 | 1,949 | 1,210,287 | 1,706 | 1,059,217 |
| III..... | do..... | 2,224 | 1,710 | 3,802,996 | 1,559 | 3,466,660 | 1,334 | 2,967,061 |
| IV..... | do..... | 2,678 | 1,460 | 3,908,742 | 1,308 | 3,503,844 | 1,112 | 2,977,216 |
| V..... | do..... | 4,798 | 1,785 | 8,566,114 | 1,629 | 7,814,344 | 1,414 | 6,784,065 |
| VI..... | do..... | 855 | 2,190 | 1,872,822 | 2,036 | 1,740,588 | 1,812 | 1,549,237 |
| Total..... | | 14,919 | 1,797 | 26,816,589 | 1,621 | 24,182,902 | 1,258 | 18,774,069 |

TABLE No. 12.—*Birch—Present stand—Continued.*

| Number of compartment. | Type. | Acres. | Cutting to a limit of 15 inches in diameter breasthigh. | | Cutting to a limit of 17 inches in diameter breasthigh. | | Cutting to a limit of 19 inches in diameter breasthigh. | |
|------------------------|-------------------------------------|--------|---|--------------|---|--------------|---|--------------|
| | | | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. |
| I..... | Swamp..... | 685 | 339 | 232,133 | 223 | 153,029 | 185 | 123,306 |
| II..... | do..... | 12 | 670 | 8,046 | 670 | 8,046 | 441 | 5,292 |
| III..... | do..... | 252 | 119 | 29,988 | 106 | 26,775 | 73 | 18,383 |
| IV..... | do..... | 595 | 276 | 164,041 | 197 | 117,043 | 133 | 78,948 |
| V..... | do..... | 438 | 484 | 187,801 | 387 | 167,363 | 275 | 119,040 |
| Total.. | | 1,977 | 815 | 622,009 | 239 | 472,256 | 176 | 348,059 |
| I..... | Spruce Land and Swamp combined..... | 4,428 | 1,712 | 7,582,943 | 1,491 | 8,600,206 | 1,256 | 5,563,639 |
| II..... | do..... | 633 | 2,090 | 1,323,151 | 1,925 | 1,213,333 | 1,682 | 1,064,509 |
| III..... | do..... | 2,476 | 1,548 | 3,832,984 | 1,411 | 3,493,435 | 1,206 | 2,985,444 |
| IV..... | do..... | 3,273 | 1,244 | 4,072,783 | 1,106 | 3,630,887 | 934 | 3,056,164 |
| V..... | do..... | 5,231 | 1,673 | 8,753,915 | 1,523 | 7,981,707 | 1,320 | 6,908,106 |
| VI..... | do..... | 855 | 2,180 | 1,872,822 | 2,080 | 1,740,588 | 1,612 | 1,549,237 |
| Total.. | | 16,896 | 1,624 | 27,438,568 | 1,459 | 24,685,158 | 1,132 | 19,122,098 |

The following table gives in board feet by Old Scribner Rule the present stand of Hard Maple on Township 40, to limits of 15, 17, and 19 inches in diameter breasthigh. This table shows also the total stand and the average stand per acre on each compartment for Spruce Land and Swamp, separately and combined.

TABLE No. 13.—*Hard Maple—Present stand.*

[Merchantable volume in board feet by Old Scribner Rule.]

| Number of compartment. | Type. | Acres. | Cutting to a limit of 15 inches in diameter breasthigh. | | Cutting to a limit of 17 inches in diameter breasthigh. | | Cutting to a limit of 19 inches in diameter breasthigh. | |
|------------------------|-------------------------------------|--------|---|--------------|---|--------------|---|--------------|
| | | | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. |
| I..... | Spruce Land..... | 3,743 | 452 | 1,691,200 | 356 | 1,333,938 | 258 | 966,750 |
| II..... | do..... | 621 | 963 | 610,276 | 870 | 540,272 | 692 | 429,889 |
| III..... | do..... | 2,224 | 1,008 | 2,242,192 | 791 | 1,758,250 | 607 | 1,350,924 |
| IV..... | do..... | 2,678 | 486 | 1,302,354 | 361 | 1,021,186 | 267 | 713,885 |
| V..... | do..... | 4,798 | 500 | 2,397,647 | 363 | 1,893,271 | 275 | 1,317,224 |
| VI..... | do..... | 855 | 325 | 277,638 | 232 | 198,687 | 149 | 127,329 |
| Total.. | | 14,919 | 571 | 8,521,567 | 443 | 6,688,604 | 329 | 4,906,001 |
| I..... | Swamp..... | 685 | 41 | 27,838 | 19 | 13,316 | 11 | 7,562 |
| II..... | do..... | 12 | 76 | 912 | ----- | ----- | ----- | ----- |
| III..... | do..... | 252 | 13 | 3,175 | ----- | ----- | ----- | ----- |
| IV..... | do..... | 595 | ----- | ----- | ----- | ----- | ----- | ----- |
| V..... | do..... | 433 | 27 | 11,570 | 16 | 6,755 | ----- | ----- |
| Total.. | | 1,977 | 22 | 43,495 | 10 | 20,071 | 4 | 7,562 |
| I..... | Spruce Land and Swamp combined..... | 4,428 | 388 | 1,719,068 | 304 | 1,347,254 | 220 | 974,312 |
| II..... | do..... | 633 | 966 | 611,188 | 854 | 540,272 | 679 | 429,889 |
| III..... | do..... | 2,476 | 907 | 2,245,387 | 710 | 1,753,250 | 546 | 1,350,924 |
| IV..... | do..... | 3,273 | 396 | 1,302,354 | 312 | 1,021,186 | 218 | 713,885 |
| V..... | do..... | 5,231 | 461 | 2,406,217 | 352 | 1,843,026 | 252 | 1,317,224 |
| VI..... | do..... | 855 | 325 | 277,638 | 232 | 198,687 | 149 | 127,329 |
| Total.. | | 16,896 | 507 | 8,565,082 | 397 | 6,708,675 | 291 | 4,913,563 |

The following table gives in board feet by Old Scribner Rule the present stand of Beech on Township 40, to limits of 15, 17, and 19 inches in diameter breasthigh. The table shows also the total stand and the average stand per acre on each compartment for Spruce Land and Swamp, separately and combined.

TABLE NO. 14.—*Beech—Present stand.*

[Merchantable volume in board feet by Old Scribner Rule.]

| Number of compartment. | Type. | Acres. | Cutting to a limit of 15 inches in diameter breasthigh. | | Cutting to a limit of 17 inches in diameter breasthigh. | | Cutting to a limit of 19 inches in diameter breasthigh. | |
|------------------------|-------------------------------------|--------|---|--------------|---|--------------|---|--------------|
| | | | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. |
| I..... | Spruce Land..... | 3,743 | 504 | 1,887,277 | 342 | 1,279,028 | 199 | 746,594 |
| II..... | do..... | 621 | 636 | 394,970 | 432 | 268,549 | 256 | 159,047 |
| III..... | do..... | 2,224 | 513 | 1,140,140 | 325 | 722,849 | 182 | 406,520 |
| IV..... | do..... | 2,678 | 269 | 720,754 | 172 | 461,816 | 100 | 268,020 |
| V..... | do..... | 4,798 | 477 | 2,287,490 | 323 | 1,547,902 | 182 | 873,084 |
| VI..... | do..... | 855 | 312 | 266,516 | 178 | 151,841 | 78 | 66,904 |
| Total..... | | 14,919 | 448 | 6,697,147 | 297 | 4,431,965 | 168 | 2,519,119 |
| I..... | Swamp..... | 685 | | | | | | |
| II..... | do..... | 12 | | | | | | |
| III..... | do..... | 252 | | | | | | |
| IV..... | do..... | 595 | | | | | | |
| V..... | do..... | 433 | 5 | 2,217 | | | | |
| Total..... | | 1,977 | 1 | 2,217 | | | | |
| I..... | Spruce Land and Swamp combined..... | 4,428 | 426 | 1,887,277 | 289 | 1,279,028 | 189 | 746,594 |
| II..... | do..... | 633 | 624 | 394,970 | 424 | 268,549 | 251 | 159,047 |
| III..... | do..... | 2,476 | 460 | 1,140,140 | 302 | 722,849 | 164 | 406,520 |
| IV..... | do..... | 3,273 | 220 | 720,754 | 141 | 461,816 | 82 | 268,020 |
| V..... | do..... | 5,231 | 438 | 2,289,707 | 306 | 1,547,902 | 187 | 873,084 |
| VI..... | do..... | 855 | 312 | 266,516 | 178 | 151,841 | 78 | 66,904 |
| Total..... | | 16,896 | 387 | 6,699,364 | 262 | 4,431,965 | 149 | 2,519,119 |

The following table is a summary of Tables Nos. 6, 7, and 9, which give the present stand of Spruce, Balsam, and Pine:

TABLE NO. 15.—*Softwoods—Present stand.*

[Total merchantable volume of Spruce, Balsam, and Pine on Township 40, in standards by Dimick's Rule.]

| Number of compartment. | Acres. | Cutting to a limit of 10 inches in diameter breasthigh. | |
|------------------------|--------|---|--------------|
| | | Average stand per acre. | Total stand. |
| I..... | 4,428 | 32.32 | 143,105.74 |
| II..... | 633 | 28.17 | 17,832.21 |
| III..... | 2,476 | 26.55 | 65,746.53 |
| IV..... | 3,273 | 24.81 | 81,188.89 |
| V..... | 5,231 | 26.12 | 136,624.10 |
| VI..... | 855 | 29.72 | 25,406.71 |
| Total..... | 16,896 | 27.81 | 409,906.18 |

TABLE NO. 15.—*Softwoods—Present stand—Continued.*

| Number of compartment. | Acres. | Cutting to a limit of 12 inches in diameter breasthigh. | |
|------------------------|--------|---|--------------|
| | | Average stand per acre. | Total stand. |
| I..... | 4,428 | 26.42 | 116,963.66 |
| II..... | 633 | 24.99 | 15,819.42 |
| III..... | 2,476 | 22.21 | 54,991.75 |
| IV..... | 3,273 | 19.44 | 63,636.20 |
| V..... | 5,231 | 21.15 | 110,649.25 |
| VI..... | 855 | 26.49 | 21,791.84 |
| Total..... | 16,896 | 22.72 | 383,874.12 |

| Number of compartment. | Acres. | Cutting to a limit of 14 inches in diameter breasthigh. | |
|------------------------|--------|---|--------------|
| | | Average stand per acre. | Total stand. |
| I..... | 4,428 | 20.75 | 91,880.85 |
| II..... | 633 | 20.65 | 13,070.88 |
| III..... | 2,476 | 17.71 | 43,843.60 |
| IV..... | 3,273 | 14.72 | 48,171.39 |
| V..... | 5,231 | 16.69 | 87,275.97 |
| VI..... | 855 | 20.15 | 17,230.92 |
| Total..... | 16,896 | 17.84 | 301,473.61 |

The following table is a summary of Tables Nos. 12, 13, and 14, which give the present stand of Birch, Maple, and Beech:

TABLE NO. 16.—*Hardwoods—Present stand.*

[Total merchantable volume of Birch, Maple, and Beech on Township 40, in standards by Dimick's Rule and in board feet by Old Scribner Rule.]

| Number of compartment. | Acres. | Cutting to a limit of 15 inches in diameter breasthigh. | | | |
|------------------------|--------|---|-------------|--------------|-------------|
| | | Average stand per acre. | | Total stand. | |
| | | Standards. | Board feet. | Standards. | Board feet. |
| I..... | 4,428 | 12.96 | 2,527 | 57,381 | 11,189,318 |
| II..... | 633 | 13.87 | 3,680 | 11,945 | 2,329,309 |
| III..... | 2,476 | 14.95 | 2,915 | 37,018 | 7,218,491 |
| IV..... | 3,273 | 9.55 | 1,862 | 31,261 | 6,095,891 |
| V..... | 5,231 | 13.19 | 2,572 | 68,969 | 13,452,339 |
| VI..... | 855 | 14.50 | 2,827 | 12,306 | 2,417,176 |
| Total..... | 16,896 | 12.96 | 2,527 | 218,900 | 42,703,024 |

| Number of compartment. | Acres. | Cutting to a limit of 17 inches in diameter breasthigh. | | | |
|------------------------|--------|---|-------------|--------------|-------------|
| | | Average stand per acre. | | Total stand. | |
| | | Standards. | Board feet. | Standards. | Board feet. |
| I..... | 4,428 | 10.69 | 2,084 | 47,315 | 9,226,490 |
| II..... | 633 | 10.42 | 3,202 | 10,386 | 2,027,154 |
| III..... | 2,476 | 12.37 | 2,413 | 30,639 | 5,974,534 |
| IV..... | 3,273 | 8.00 | 1,559 | 26,174 | 5,103,889 |
| V..... | 5,231 | 11.15 | 2,174 | 58,321 | 11,372,635 |
| VI..... | 855 | 12.54 | 2,446 | 10,724 | 2,091,116 |
| Total..... | 16,896 | 10.86 | 2,119 | 183,569 | 35,795,818 |

TABLE NO. 16.—*Hardwoods—Present stand—Continued.*

| Number of compartment. | Acres. | Cutting to a limit of 19 inches in diameter breasthigh. | | | |
|------------------------|--------|---|-------------|--------------|-------------|
| | | Average stand per acre. | | Total stand. | |
| | | Standards. | Board feet. | Standards. | Board feet. |
| I..... | 4,428 | 8.44 | 1,645 | 37,357 | 7,284,545 |
| II..... | 633 | 13.40 | 2,612 | 8,479 | 1,653,445 |
| III..... | 2,476 | 9.82 | 1,915 | 24,317 | 4,741,888 |
| IV..... | 3,273 | 6.33 | 1,234 | 20,708 | 4,038,069 |
| V..... | 5,231 | 8.91 | 1,738 | 46,633 | 9,093,363 |
| VI..... | 855 | 10.46 | 2,039 | 8,941 | 1,743,470 |
| Total..... | 16,896 | 8.67 | 1,690 | 146,435 | 28,554,780 |

FUTURE STAND OF SPRUCE.

A study of the rate of growth of Spruce has been made by the Division of Forestry in several parts of the Adirondacks, in both cut-over and virgin forest. Similar measurements of growth were made on Township 39, under forest conditions closely resembling those on Township 40. By means of these measurements it was possible to select from the several tables compiled by the Division of Forestry, showing the rate of growth of Spruce, that which applies most closely to the Spruce upon Township 40. The table chosen and given below was made from measurements taken at Tahawus, Essex County, New York, on land where the conditions of growth of Spruce were sufficiently similar to those on Township 40 to make safe its application to that tract. The increased increment which followed the opening of the forest by lumbering has been disregarded, in order to insure a thoroughly safe and conservative estimate. The table chosen was compiled from analyses of 461 trees.

The following table shows the average annual increase in diameter for Spruce of various sizes, and the number of years required to grow 1 inch:

TABLE NO. 17.—*Rate of growth in diameter of Spruce.*

| Diameter breast-high. | Annual growth. | Time required to grow 1 inch. |
|-----------------------|----------------|-------------------------------|
| <i>Inches.</i> | <i>Inches.</i> | <i>Years.</i> |
| 3 | 0.0460 | 22 |
| 4 | .0605 | 17 |
| 5 | .0718 | 14 |
| 6 | .0825 | 12 |
| 7 | .0933 | 11 |
| 8 | .1040 | 10 |
| 9 | .1150 | 9 |
| 10 | .1260 | 8 |
| 11 | .1350 | 7 |
| 12 | .1425 | 7 |
| 13 | .1485 | 7 |
| 14 | .1545 | 6 |
| 15 | .1595 | 6 |
| 16 | .1645 | 6 |
| 17 | .1685 | 6 |
| 18 | .1725 | 6 |

The following table has been constructed from Table No. 17, and shows the growth in diameter to be expected in trees of 4 to 13 inches, breasthigh, in periods ranging by decades from 10 to 60 years:

TABLE NO. 18.—*Growth in diameter of Spruce by 10-year periods.*

| Present diameter breast-high. | Diameter breast-high after 10 years. | Diameter breast-high after 20 years. | Diameter breast-high after 30 years. | Diameter breast-high after 40 years. | Diameter breast-high after 50 years. | Diameter breast-high after 60 years. |
|-------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
| <i>Inches.</i> | <i>Inches.</i> | <i>Inches.</i> | <i>Inches.</i> | <i>Inches.</i> | <i>Inches.</i> | <i>Inches.</i> |
| 4 | | | | | | 8.62 |
| 5 | | | | 8.31 | 9.36 | 10.50 |
| 6 | | | 8.73 | 9.80 | 11.00 | 12.43 |
| 7 | | 8.94 | 10.00 | 11.27 | 12.71 | 14.15 |
| 8 | 9.00 | 10.13 | 11.40 | 12.86 | 14.31 | 16.00 |
| 9 | 10.13 | 11.40 | 12.86 | 14.31 | 16.00 | 17.67 |
| 10 | 11.27 | 12.71 | 14.15 | 15.80 | 17.51 | |
| 11 | 12.43 | 13.89 | 15.43 | 17.17 | 18.87 | |
| 12 | 13.45 | 15.00 | 16.66 | 18.34 | | |
| 13 | 14.46 | 16.16 | 17.84 | | | |

Knowing from the valuation surveys the number of trees per acre of various diameters down to 5 inches, breasthigh, the future stand may be calculated by the use of Table No. 18. For purposes of comparison, the yield which might be obtained in the next five decades if the present cut were made to a diameter limit of 10, 12, or 14 inches, breasthigh, respectively, has been calculated. The following table shows the yields of Spruce which might be obtained after successive ten-year periods on Township 40, expressed in standards, and the number of years which must elapse before an equal cut can be obtained, provided the same diameter limit is adhered to at that time:

TABLE NO. 19.—*Estimate of future yield per acre of Spruce on merchantable area.*

| Cutting limit: diameter breast-high. | Average present stand per acre. | Average cut per acre obtainable at the end of ten-year periods, in standards. | | | | | Interval required between equal cuts. |
|--------------------------------------|---------------------------------|---|------|-------|-------|-------|---------------------------------------|
| | | 10 | 20 | 30 | 40 | 50 | |
| <i>Inches.</i> | <i>Standards.</i> | | | | | | <i>Years.</i> |
| 10 | 22.94 | 1.90 | 5.20 | 10.00 | 16.10 | 24.20 | 50 |
| 12 | 19.43 | 2.20 | 6.20 | 12.40 | 20.70 | ----- | 39 |
| 14 | 15.56 | 3.80 | 9.20 | 16.60 | ----- | ----- | 29 |

The following table shows, in percentages of the present cut to the three diameter limits, what the future cuts will be in from ten to fifty years:

TABLE NO. 20.—*Future cuts of Spruce, expressed in percentages of present stand.*

| Cutting limit: diameter breast-high. | Average present stand per acre. | Average cut per acre obtainable at the end of ten-year periods, expressed in percentages of present stand. | | | | | Interval required between equal cuts. |
|--------------------------------------|---------------------------------|--|----------------|----------------|----------------|----------------|---------------------------------------|
| | | 10 | 20 | 30 | 40 | 50 | |
| <i>Inches.</i> | <i>Standards.</i> | <i>Per ct.</i> | <i>Per ct.</i> | <i>Per ct.</i> | <i>Per ct.</i> | <i>Per ct.</i> | <i>Years.</i> |
| 10 | 22.94 | 8.3 | 22.7 | 43.7 | 70.3 | 105.7 | 50 |
| 12 | 19.43 | 11.3 | 32.0 | 63.9 | 106.6 | ----- | 39 |
| 14 | 15.56 | 24.4 | 59.0 | 106.4 | ----- | ----- | 29 |

Table No. 21 shows the total future yield of Spruce to be expected from the merchantable area of Township 40, in from ten to fifty years, after cutting to 10, 12, or 14 inches.

TABLE NO. 21.—*Estimate of total future yield of Spruce on merchantable area.*

| Cutting limit: diameter breast-high. | Total present stand. | Total yield per acre obtainable at the end of ten-year periods, in standards. | | | | | Interval required between equal cuts. |
|--------------------------------------|----------------------|---|------------|------------|------------|------------|---------------------------------------|
| | | 10 | 20 | 30 | 40 | 50 | |
| <i>Inches.</i> | <i>Standards.</i> | | | | | | <i>Years.</i> |
| 10 | 387,596.59 | 32,102.40 | 87,859.20 | 168,960.00 | 272,025.60 | 408,883.20 | 50 |
| 12 | 323,287.56 | 37,171.20 | 104,755.20 | 209,510.40 | 349,747.20 | ----- | 39 |
| 14 | 263,953.68 | 64,204.80 | 155,443.20 | 280,473.60 | ----- | ----- | 29 |

It will be seen from these tables that if 10 inches be adopted as the present diameter limit, almost fifty years must elapse before an equal cut can again be obtained. The rotation with a 12-inch limit is thirty-nine years, while if 14 inches be chosen, twenty-nine years will be the interval between equal cuts. A comparison of the amounts to be obtained shows that it is more profitable to cut to a 12-inch limit than to a 10-inch limit, and also that cutting to 14 inches will yield more in the long run than cutting to 12 inches. The present yield to a 14-inch limit is not, however, large enough to justify the construction of logging roads, the building of camps, the improvement of streams, and the meeting of other expenses necessary for lumbering. Cutting to 12 inches the present yield is 19.43 standards per acre, an amount sufficiently large to make sure a margin of profit in lumbering. With a 12-inch limit the trees of large size which have reached their maturity would be removed, with a consequent benefit to the remaining growth and to the forest, while a sufficient number of seed trees would be left to insure the reproduction of Spruce.

A diameter limit of 12 inches is preferable to a smaller limit, because a larger number of seed trees would be left standing and the chances for the reproduction of the Spruce would be proportionately increased. Moreover, cutting to 10 inches would remove many trees which although old are still thrifty, and which, after the first cutting, will add to their merchantable contents far more rapidly than would those smaller trees which would remain if a lower diameter limit were fixed. The more conservative limit will also protect the watersheds better and minimize the damage to the forest from lumbering. It is believed, therefore, for the several reasons above stated, that 12 inches will be preferable to any other diameter limit to which to cut the Spruce. It must be clearly understood, however, that this diameter limit is subject to local modification at the discretion of the man who marks the trees. It is not an arbitrary figure, but merely an average to aid in fixing the yield and in marking the trees to be cut. It will, under

certain conditions, be necessary for the good of the forest to leave Spruce of over 12 inches and to cut trees below 12 inches in diameter.

Table No. 22 is constructed from Table No. 21, and shows what will be the money returns of future cuts of Spruce in from ten to fifty years, at 40, 50, and 60 cents per standard. It is not intended to be more than an approximation; but, assuming that the present prices will obtain in the future, it shows the returns to be expected.

TABLE No. 22.—*Estimate of future returns from Spruce stumpage on merchantable area at the end of ten-year periods.*

STUMPAGE AT 40 CENTS PER STANDARD.

| Cutting limit: diameter breast- high. | Present value. | 10 | 20 | 30 | 40 | 50 |
|--|-------------------|----------|----------|----------|-----------|-----------|
| <i>Inches.</i> | | | | | | |
| 10 | \$155,099 | \$12,841 | \$35,144 | \$67,584 | \$108,810 | \$163,553 |
| 12 | 131,815 | 14,868 | 41,902 | 83,804 | 139,899 | ----- |
| 14 | 106,181 | 25,682 | 62,177 | 112,189 | ----- | ----- |

STUMPAGE AT 50 CENTS PER STANDARD.

| | | | | | | |
|----|-----------|----------|----------|----------|-----------|-----------|
| 10 | \$193,798 | \$16,051 | \$43,930 | \$84,480 | \$136,013 | \$204,442 |
| 12 | 164,144 | 18,586 | 52,378 | 104,755 | 174,874 | ----- |
| 14 | 131,477 | 32,102 | 77,722 | 140,237 | ----- | ----- |

STUMPAGE AT 60 CENTS PER STANDARD.

| | | | | | | |
|----|-----------|----------|----------|-----------|-----------|-----------|
| 10 | \$232,558 | \$19,261 | \$52,716 | \$101,376 | \$163,215 | \$245,330 |
| 12 | 196,973 | 22,303 | 62,853 | 125,706 | 209,848 | ----- |
| 14 | 157,772 | 38,523 | 93,286 | 168,284 | ----- | ----- |

SPECIES TO BE LUMBERED.

SPRUCE, BALSAM, AND PINE.

While estimates have been given for eight species, it is advised that lumbering should be restricted for the present to Spruce, Balsam, and Pine. As has been stated under "Future Stand of Spruce," the diameter limit to which the Spruce should be cut, under the present plan, has been fixed at 12 inches breasthigh.

In Table No. 7 the stand of Balsam has been given for trees 10 inches and over in diameter breasthigh, and in Table No. 8 for trees 6 to 9 inches breasthigh. The stand to 10 inches is 16.4 per cent of the total stand of Spruce to 12 inches. Since in lumbering it is customary to put in 15 per cent of Balsam with the Spruce, it would reach this amount for the whole tract if cut to 10 inches only. Should it be possible, however, to lumber more Balsam than is necessary to make 15 per cent of the Spruce, the total merchantable stand might be taken, except in those few localities designated by the inspector where

the local conditions require that clean cutting should not be made. Balsam being one of the inferior trees, the condition of the forest would be rather improved than injured by its removal, since more room would be made for the more valuable species.

As is shown in the preceding tables, the first-growth White Pine on Township 40 is mostly mature, almost all the trees being of large size. These Pines should be lumbered except within the reserve belt along the banks of the lakes and rivers. A 14-inch diameter limit is recommended because trees of this size are merchantable and should come out, and because cutting to this limit will leave a certain number of trees for seed. Cutting to 14 inches will yield an amount of Pine equal to 8 per cent of the cut of Spruce to 12 inches.

These diameter limits for Spruce, Balsam, and Pine refer, as has been stated, to the diameter breasthigh, or $4\frac{1}{2}$ feet from the ground. These limits must not be confounded with what the diameter would be at the cutting point on the stump, as the following table shows.

The figures used in constructing this table were determined by 2,624 measurements taken on this tract and upon Township 39, where lumbering has been carried on under the supervision of the Division of Forestry during the past summer (1900). The work was done under watchful inspection and according to the rules of the Division for lumbering, and all stumps were cut at the lowest practicable point. The measurements were very carefully taken, and the results may be relied upon for Spruce.

TABLE NO. 23.—*Comparative average diameters of Spruce.*

| At breast-height. | At lowest practicable cutting point. | At top of root swelling. | At breast-height. | At lowest practicable cutting-point. | At top of root swelling. |
|-------------------|--------------------------------------|--------------------------|-------------------|--------------------------------------|--------------------------|
| <i>Inches.</i> | <i>Inches.</i> | <i>Inches.</i> | <i>Inches.</i> | <i>Inches.</i> | <i>Inches.</i> |
| 10 | 11.9 | 13.0 | 21 | 24.1 | 25.9 |
| 11 | 13.0 | 14.1 | 22 | 25.3 | 27.1 |
| 12 | 14.1 | 15.3 | 23 | 26.4 | 28.2 |
| 13 | 15.2 | 16.5 | 24 | 27.5 | 29.4 |
| 14 | 16.3 | 17.7 | 25 | 28.6 | 30.6 |
| 15 | 17.4 | 18.8 | 26 | 29.7 | 31.7 |
| 16 | 18.5 | 20.0 | 27 | 30.9 | 32.9 |
| 17 | 19.7 | 21.2 | 28 | 32.0 | 34.0 |
| 18 | 20.8 | 22.4 | 29 | 33.1 | 35.2 |
| 19 | 21.9 | 23.5 | 30 | 34.2 | 36.4 |
| 20 | 23.0 | 24.7 | | | |

The increasing difference between the diameter at breastheight, at the cutting point, and at the top of the root swelling, is explained by the fact that on the larger trees the swelling of the roots reaches higher, and consequently increases the diameter at the top of the root swelling in comparison with the diameter breasthigh. Thus, the larger the tree the greater the taper from the top of the root swelling to breastheight. For a discussion of the cutting point see page 55.

The same general proportion shown by this table applies to Balsam and Pine.

The following table shows the stand of Spruce to 12 inches, Balsam to 10 inches, and Pine to 14 inches breasthigh, with the totals for the merchantable area in the several compartments. It must be borne in mind that Pine Land is not distinct from Spruce Land and Swamp, but is that part of them in which Pine forms any considerable portion of the growth.

TABLE NO. 24.—*Present stand of Spruce 12 inches and over, Balsam 10 inches and over, and Pine 14 inches and over breasthigh, on each compartment of Township 40.*

| Number of compartment. | Species. | Type. | Acres. | Merchantable volume. | | | |
|------------------------|----------------|-------------------|--------|-----------------------------|--------------|----------------------------------|-------------|
| | | | | Standards by Dimick's Rule. | | Board feet by Old Scribner Rule. | |
| | | | | Average stand per acre. | Total stand. | Average stand per acre | Total stand |
| I | { Spruce | { Spruce Land and | 4,428 | { 22.34 | 98,935.83 | 4,356 | 19,292,487 |
| | { Balsam | { Swamp. | | { 2.93 | 12,999.05 | 571 | 2,528,964 |
| | { Pine | { Pine Land | 2,533 | 4.86 | 12,312.05 | 948 | 2,400,850 |
| | Total | | 4,428 | 28.05 | 124,216.93 | 5,470 | 24,222,301 |
| II | { Spruce | { Spruce Land and | 633 | { 23.31 | 14,752.49 | 455 | 2,876,736 |
| | { Balsam | { Swamp. | | { 1.05 | 665.44 | 206 | 129,761 |
| | { Pine | { Pine Land | 500 | 1.50 | 750.70 | 233 | 146,386 |
| | Total | | 633 | 25.54 | 16,168.63 | 4,980 | 3,152,883 |
| III | { Spruce | { Spruce Land and | 2,476 | { 17.31 | 42,869.19 | 3,375 | 8,359,492 |
| | { Balsam | { Swamp. | | { 3.38 | 8,379.51 | 659 | 1,634,004 |
| | { Pine | { Pine Land | 1,920 | 3.93 | 7,548.34 | 766 | 1,471,926 |
| | Total | | 2,476 | 23.75 | 58,797.04 | 4,631 | 11,465,422 |
| IV | { Spruce | { Spruce Land and | 3,273 | { 16.02 | 52,441.33 | 3,124 | 10,226,059 |
| | { Balsam | { Swamp. | | { 4.54 | 14,849.73 | 885 | 2,895,967 |
| | { Pine | { Pine Land | 3,273 | 1.05 | 3,435.23 | 205 | 669,870 |
| | Total | | 3,273 | 21.61 | 70,726.29 | 4,214 | 13,791,626 |
| V | { Spruce | { Spruce Land and | 5,231 | { 18.84 | 98,569.92 | 3,674 | 19,221,134 |
| | { Balsam | { Swamp. | | { 2.94 | 15,381.57 | 573 | 2,999,406 |
| | { Pine | { Pine Land | 3,768 | 1.05 | 3,951.14 | 205 | 770,472 |
| | Total | | 5,231 | 22.54 | 117,902.63 | 4,395 | 22,991,012 |
| VI | { Spruce | { Spruce Land and | 855 | { 24.23 | 20,718.79 | 4,725 | 4,040,164 |
| | { Balsam | { Swamp. | | { 1.96 | 1,672.81 | 382 | 326,198 |
| | { Pine | { Pine Land | 855 | .07 | 60.30 | 14 | 11,759 |
| | Total | | 855 | 26.26 | 22,451.90 | 5,121 | 4,378,121 |
| | { Spruce | { Spruce Land and | 16,896 | { 19.43 | 328,287.55 | 3,789 | 64,016,072 |
| | { Balsam | { Swamp. | | { 3.19 | 53,918.11 | 622 | 10,514,050 |
| | { Pine | { Pine Land | 12,849 | 2.18 | 28,057.76 | 425 | 5,471,263 |
| | Total | | 16,896 | 24.28 | 410,263.42 | 4,735 | 80,001,367 |

Table No. 25 shows the present stand of Spruce 12 inches and over, Balsam 10 inches and over, and Pine 14 inches and over breasthigh, on the three lumbering blocks of Township 40. (See Map III.)

TABLE NO. 25.—*Present stand of Spruce, Balsam, and Pine by lumbering blocks.*

| Number of block. | Number of compartment. | Species. | Type. | Acres. | Merchantable volume. | | | |
|------------------|------------------------|-------------------|--|--------|-----------------------------|--------------|----------------------------------|--------------|
| | | | | | Standards by Dimick's Rule. | | Board feet by Old Scribner Rule. | |
| | | | | | Average stand per acre. | Total stand. | Average stand per acre. | Total stand. |
| 1 | I | Spruce | Spruce Land and Swamp. Pine Land | 4,428 | 22.34 | 98,935.83 | 4,356 | 19,292,487 |
| | | Balsam | | 2,533 | 2.93 | 12,989.05 | 571 | 2,528,994 |
| | | Pine | | | 4.86 | 12,312.05 | 948 | 2,400,850 |
| | | Total | | 4,428 | 28.05 | 124,216.93 | 5,470 | 24,222,301 |
| 2 | II III IV V | Spruce | Spruce Land and Swamp. Pine Land | 11,613 | 17.97 | 206,632.93 | 3,504 | 40,683,421 |
| | | Balsam | | 9,461 | 3.38 | 39,276.25 | 659 | 7,658,899 |
| | | Pine | | | 1.66 | 15,685.41 | 324 | 3,058,655 |
| | | Total | | 11,613 | 22.70 | 269,594.59 | 4,493 | 51,400,945 |
| 3 | VI | Spruce | Spruce Land and Swamp. Pine Land | 855 | 24.23 | 20,718.79 | 4,725 | 4,040,164 |
| | | Balsam | | 855 | 1.96 | 1,672.81 | 382 | 326,198 |
| | | Pine | | | .07 | 60.30 | 14 | 11,759 |
| | | Total | | 855 | 26.26 | 22,451.90 | 5,121 | 4,378,121 |
| | | Grand total | | 16,896 | 24.28 | 410,263.42 | 4,735 | 80,001,367 |

CEDAR.

The stand of merchantable Cedar on Township 40 is so scattered that no limit for cutting has been fixed. There is no generally accepted stumpage rate for Cedar in this locality, and advantageous market conditions would depend largely upon whether some of the improvements advised later in this working plan were made. In some places all the live merchantable trees should be cut. It is recommended that the sale of Cedar be left to the discretion of the forest officials.

Under "Recommendations for a Mill and Branch Railroad" (p. 44), suggestions will be found regarding the utilization and sale of the dead Cedar on the township.

DEAD SPRUCE.

In order to show how the mature trees are going to waste on Township 40, the dead Spruce were calipered and recorded on the valuation surveys. No stubs nor broken-top trees were included, and only those 10 inches and over in diameter breasthigh were measured. The result is shown in the following table

TABLE NO. 26.—*Dead Spruce on Township 40.*
[Average of trees 10 inches and over in diameter breasthigh.]

| Type. | Number of valuation surveys. | Average number of trees per acre. | Average diameter breast-high. | Maximum diameter breast-high. |
|-------------------------------|------------------------------|-----------------------------------|-------------------------------|-------------------------------|
| | Acres. | | Inches. | Inches. |
| Spruce Land | 953 | 1.623 | 18.6 | 30 |
| Swamp | 90 | .900 | 16.9 | 27 |
| Total merchantable area | 1,043 | 1.561 | 18.5 | 30 |
| Upper Spruce Slope | 37 | 2.000 | 17.1 | 29 |

It will be seen that the dead Spruce are for the most part lar trees. The contents of a tree 18 inches in diameter breasthigh 1.79 standards, or 349 feet B. M. On the whole merchantable area 16,896 acres there would be 26,375 dead Spruce, with an average contents of 1.79 standards. The total dead Spruce gone to waste is 47,211.25 standards, which, with a stumpage value of 50 cents standard, means a loss of \$23,605.62. That such waste should be prevented hereafter is clear. If cut at once, many of the trees listed as dead Spruce could be still utilized for lumber and some of them would make good saw logs.

REMAINING SPECIES.

There are strong reasons why the remaining species should not be lumbered now. There is a good stand of young Hemlock on the tract but as it is yet far from mature better returns will be obtained by allowing the trees to grow than could be got from their present sale. Besides this, Hemlock bark is not sufficiently thick on small trees to make it valuable, nor heavy enough to sell to advantage by weight. That the bark should be used when this species is logged is obvious both because of its value and because in order to drive the logs the bark must be removed. In addition, the value of Hemlock is at present comparatively small. A rise in value may reasonably be expected in the future, since Hemlock is being used more and more in the place of Spruce as the demand for the latter increases.

HARDWOODS.

There are several reasons which make present lumbering of hardwoods inadvisable. It is recognized that for the benefit of the young growth it would be best to remove the large hardwoods at once and so improve the conditions for reproduction of the more valuable softwoods. (But present rates render the logging of hardwoods in Township 40 impracticable. Prices do not warrant generally the cost of building logging roads nor the hauling of logs to the present road, which would be necessary, since it is not feasible to drive hardwoods.)

However, with the construction of a manufacturing plant on Township 40 and the necessary branch railroad connecting with the Raquette Lake Railway, the more valuable species, as Birch, Hard Maple, Beech, Black Cherry, and White Ash, of the larger diameter would undoubtedly find a ready sale at good prices. The roads that had been cut for the Spruce and Pine could be utilized for removing the hardwoods. The cost of lumbering would be reduced and, consequently, the stumpage would become more valuable, while the timber might be sold for fuel or for the manufacture of charcoal, wood alcohol, etc. This should be done in order to get them out of the way and so lessen the danger from fire.



The larger portion of the hardwood timber on Township 40, tributary to Raquette Lake, is on Compartments Nos. II, III, and V, and could be brought to the hereafter proposed location for a mill much more cheaply than to the present railroad station on the lake.

For these reasons it would be more profitable to lumber the softwoods first and the hardwoods afterwards, although the opposite arrangement would be better for the forest.

NATURAL ADVANTAGES OF TOWNSHIP 40 FOR LUMBERING.

Township 40 is a particularly desirable tract upon which to begin conservative lumbering by the State. Its timber is mature, and under proper restrictions may be removed with entire safety to the forest, transportation will be cheap and easy, large markets are easily accessible, and the work and its results will be fully open to public inspection. The streams tributary to Raquette Lake, which, as will be seen by a glance at the map, come in from all sides and run in most cases completely across the township, make easy and natural outlets for all the timber to the lake, with the exception hereafter noted. Raquette Lake has two outlets, the Raquette River to the north, which leads to the markets and mills below, and the Raquette Lake Railway, which connects with the New York Central Railroad at Clearwater Junction. The timber on the northeast quarter is tributary to Forked Lake or Brandreth Lake Outlet. The latter runs from the north line of the township southeasterly into Forked Lake, and is fed by several small streams on each side. These afford a natural outlet for all the timber on that portion of the tract designated as Compartment No. I, by way of Forked Lake into the Raquette River, and down the latter, which leads to the markets of Tupper Lake and Piercefield, where are some of the largest lumbering plants, sawmills, pulp mills, and manufactories in the Adirondacks.

The larger part of the timber upon Townships 6, 5, and 41, which is owned almost entirely by the State, is also tributary to Raquette Lake. If these townships were to be lumbered together with Township 40, it would pay to make permanent improvements, such as roads and dams, in addition to those advised in this working plan. These additional improvements would be hardly justified, however, on Township 40 alone, on account of the comparatively small amount of timber remaining after the deduction of the summit reserves and the reserved strips along the lake front, together with the water acreage.

The topography of Township 40 is very favorable for lumbering. The small streams which reach across the township have, with few exceptions, a gradual descent to the lake, and empty into it in some sheltered bay where logs may lie safely boomed after the ice breaks up in the spring, protected by the trees about the shores from being driven about and scattered by heavy storms. Here they could rest safely until it should be deemed advisable to tow them by steamer

or otherwise to some point where they could be loaded upon cars, or to the Outlet, down which they could be driven to the markets below, or to some point on the lake where there might be a mill erected to manufacture the lumber. The railroad, which has been completed from Clearwater to Raquette Lake, and the steamboat lines on the lake could well be used to bring in the necessary men, supplies, tools, and outfit for removing the timber. At present there are several steamboats which could be hired with their crews at very reasonable figures. These boats would make it entirely unnecessary for the lumberman to incur the expense of building steamboats to do this portion of the work, or of hauling supplies over a long supply road with teams. Supplies could be moved quickly and cheaply to any desired point on the lake, whence it would not be a long distance by road to any place where a lumber camp would naturally be located. Long-distance telephone and telegraph lines traverse the township, making possible quick communication with a base of supplies—a condition which is found in hardly any other locality which could be selected in the New York State Forest Preserve.

It is plain from these facts that unusual natural advantages, together with the excellent facilities for transportation, make this tract an especially favorable one for profitable lumbering.

DIVISION OF TOWNSHIP INTO COMPARTMENTS.

It was, as has been explained, considered advisable, for the purpose of estimating the stand of timber, to divide the township into six compartments. Map III shows the boundaries of these compartments by broken lines.

Compartment No. I contains all the northeast quarter of the township naturally tributary to Forked Lake or Brandreth Lake Outlet, except that portion which, although naturally tributary to Brandreth Lake Outlet, has been included in Compartment No. V. This exception has been made because the log haul would be materially shortened by leaving the brook at the point indicated as "available short haul" on Map III and going south across the marsh to strike the small brook running into Stillman Bay, on Raquette Lake. The cost of hauling logs for that portion of the tract would in this way be greatly diminished. Compartment No. I is an important one, for the reason that its timber can not be lumbered into Raquette Lake cheaply, but must go to Forked Lake, and thence north by way of the Raquette River.

Compartments Nos. II, III, IV, and V are simply the subdivisions of the Raquette Lake tract into the several subordinate watersheds, separating those portions of the township naturally tributary to the various inlets of the lake.

No. II includes that portion tributary to Outlet Bay on each side of the lake. No. III comprises the area tributary to Boulder Brook.

No. IV contains the section naturally tributary to Marion River and South Bay in the southeast quarter, and also that in the southwest quarter tributary to Otter Bay and Browns Tract Inlet. No. V covers that part of the township which is naturally tributary to Beaver Bay, Lonesome Bay, and Sucker Brook Bay, by way of Cranberry Pond Outlet, and all the timber lying on the east side of West Mountain and tributary to Stillman Bay by way of Lone Pond Stream, and as far east as the Ten Eyck private holding. No. VI is a small compartment which lies back of West Mountain and includes Otter Pond. The timber upon it is not naturally tributary to either Raquette Lake or Forked Lake, but could be brought across into Cranberry Pond Outlet.

In dividing the township into tracts for lumbering, the six compartments into which it was divided, for the purpose of estimating the stand of timber, fall naturally into three blocks. One includes that portion tributary to the Brandreth Lake Outlet and Forked Lake (Compartment No. I); another, that portion tributary to Raquette Lake (Compartments Nos. II, III, IV, V), and which should be lumbered to that point; and the third (Compartment VI), the small compartment back of West Mountain, from which the timber would naturally go to Moose River. The latter should be lumbered with the timber on Township 41 in the same valley and watershed, but could be brought to Raquette Lake via Otter Pond. (See available route shown on Map III.) If this route were used it would be necessary to employ tow teams to help in hauling the logs from Otter Pond to the top of the divide between this compartment and No. V; or, since the ascent is short, although comparatively steep, the work could be satisfactorily done by the aid of a small hoisting engine and wire cable at the top of the divide.

NATURAL OUTLETS FOR TIMBER.

There are only two outlets advisable for any of the timber on Township 40, and but one for that portion of the northeast quarter which is included in Compartment No. I. As already explained, all the timber on this compartment must of necessity go out by way of Forked Lake and the Raquette River (outlet of Forked Lake), through Long Lake and the Raquette River again, and so down to some of the many manufacturing points below. But, although there is only one outlet for Compartment No. I, there would be no trouble in disposing of the stumpage on this compartment for its full value, as there are a number of responsible lumbermen and manufacturers who have already signified their intention to bid for the timber if it is offered for sale.

There is a small amount of timber on the northern slopes of Pilgrim and Nigger Head mountains, near the north corner of the township, which could be brought to Brandreth Lake Outlet, but which could be

hauled more cheaply direct to Forked Lake by way of High Pond. (See Map III.)

All the rest of the timber on the tract, except that upon Compartment No. VI, could be brought to the lake on a down-grade road by following the watercourses of some of the inlets and their small feeders, and would have two available outlets to market, one by the natural water outlet of Raquette Lake into Forked Lake, from there into the Raquette River, and so down to the manufacturing plants which are located at various points along the stream below, from Tupper Lake to Potsdam and Norwood; the other by way of the Raquette Lake Railway, which, as will be seen from the map, touches the lake at a point near the entrance of Browns Tract Inlet.

This affords a means of transportation for either logs or lumber direct from the lake to any desired point. This fact should have marked effect upon the bidding for the stumpage on this tract. It will readily be seen that the manufacturer who has a plant located at some distant point not on the Raquette River could get the timber to his mill more cheaply and quickly by loading it upon cars at Raquette Lake and shipping it direct to his mill than by driving it downstream to the nearest point where a railroad could be reached (which is at present Tupper Lake village), as he would otherwise be compelled to do. When there, after paying the cost of driving and of sorting the logs from the other timber in the stream, he would still have the additional cost of loading and of transport to his mill—an added expense which would not allow him to compete successfully with the manufacturer whose mill is on the natural outlet. But the railroad, coming directly to the lumbering center of the tract, makes it possible to load and ship the timber right from the lake without the expense of driving the logs, and the purchaser from a distance would therefore be able to offset the cost of loading and transport against the cost of driving. Hence he could afford to pay as much for the stumpage as the man on the stream below, provided he could secure satisfactory freight rates.

LUMBERING—GENERAL.

There are two ways in which Township 40 might be lumbered; the one by the State itself, the other through the sale of stumpage by the State.

LUMBERING BY THE STATE.

Lumbering by the State would necessarily entail the purchase of a large lumbering outfit, such as horses, sleds, wagons, blankets, dishes, etc., the hiring of clerks, foremen, and cooks, and all the detail work incident to the practical execution of a lumber job. State or governmental organizations are badly suited to work of this kind. It is altogether unlikely that the State would be the gainer financially by

carrying on the lumbering. The private lumberman, with his knowledge of all the methods of securing necessary help and supplies, and with his lumbering outfit already on hand, can undoubtedly lumber more cheaply, and would be willing to pay at least as much for the stumpage as the State could hope to realize by doing its own lumbering. The task would be still more complicated if the State should erect a mill and manufacture and market the lumber. For these reasons lumbering by the State is not advisable.

THE SALE OF STUMPAGE BY THE STATE.

The fact that the end of the supply of Spruce timber throughout the State is plainly in view furnishes a potent reason why the stumpage may be sold for its full value.

The stumpage upon each compartment separately or upon the whole tract could be put up for sale to the highest bidder, to be removed under certain rules and restrictions, about which more will be said further on. The method of sale would, of course, be regulated by the State officials in charge of this work, but it should be by sealed bids, the timber to go to the highest bidder, since it is probable that by this method the State would receive a higher price for the stumpage than if it were sold at private sale.

Lumbering by the sale of stumpage, with the understanding that the timber should be removed, would be particularly advisable for Compartment No. I in the northeast quarter of the township, as there is hardly enough timber in that part of the tract to warrant the erection of a mill. Logs have already been driven from the east line of Township 40 to Tupper Lake and Piercefield, and that would be the best way to dispose of the timber on this compartment.

The timber on the remainder of the tract should be sold to one purchaser. It would thus undoubtedly bring a higher price and attract a more reliable class of bidders than if it were sold in small lots. Such sale would also avoid the necessity of having a large number of contracts with small contractors, and would lessen the burden of supervision which necessarily goes with operations of this kind with irresponsible "wildeat" jobbers. The timber would also probably be cut in a much more satisfactory manner and with less friction between the lumberman and the inspector. The purchaser of the stumpage would, of course, have the option of reselling it to the small contractors, but he himself would be bound by the contract and held responsible for the careful cutting of the timber according to the rules and methods prescribed. It follows, therefore, that the best way to lumber Township 40 is by the sale of stumpage to the highest bidder. Under this plan the purchaser should have the right to build a mill at a point on the lake which could be easily connected by a railroad spur with the Raquette Lake Railway, for reasons stated fully under "Recommendations for a Mill and Branch Railroad." (See p. 44.) He should

also have the right to improve the stream and to build a dam at the foot of Raquette Lake—a matter which is discussed fully under “Recommendations for a Dam at the Foot of Raquette Lake.” (See p. 47.) As shown later, neither dam nor mill will destroy the use or beauty of the lake as a resort.

There are a number of possibilities in the lumbering of Township 40, which are shown on Map III. A careful study of this map is advised for those interested in the working plan.

RECOMMENDATIONS FOR A MILL AND BRANCH RAILROAD.

(A strong argument in favor of allowing a mill to be built on the shore of Raquette Lake is that any reputable firm, after having gone to the necessary expense entailed thereby, would be particularly careful to see that the rules for cutting were observed, lest by violating the contract they should forfeit the right to cut the timber, and thus lose the money they had invested in the mill. (A second advantage derived by the State would be that, since logs could be taken from the water directly into the mill, avoiding the expense of driving them a long distance or loading them on cars to be taken to the place of manufacture, the lumberman could afford to pay a higher price for the stumpage, provided it were possible to obtain a sufficient quantity of timber to warrant the erection of a mill and the building of a spur track to connect it with the main line of the railroad.

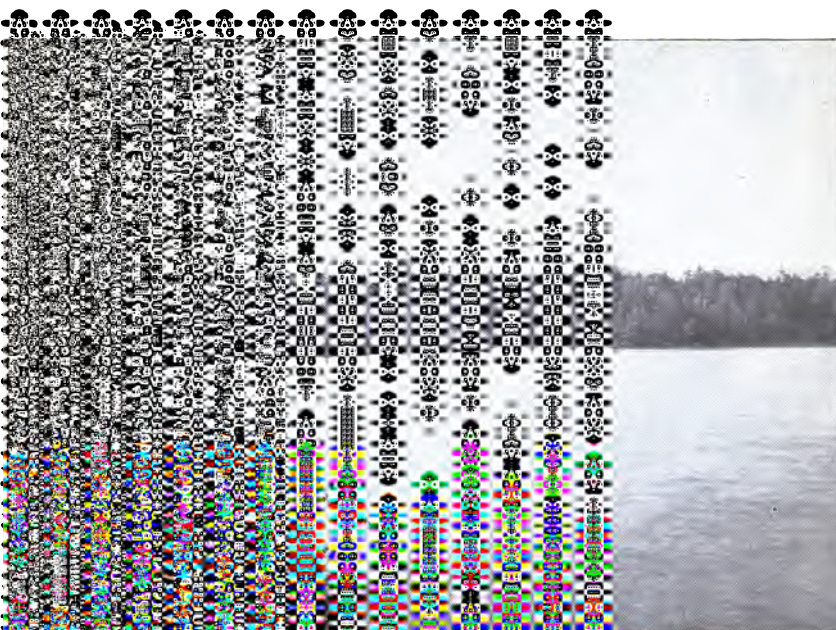
If logs or lumber were to go out by rail, there are the following reasons why it would be advisable to allow the construction of a spur railroad track to Sucker Brook Bay. (See available railroad route and mill location on Map III; also shown in Pl. V, figs. 1 and 2.)

There is a large storage area at this point where timber could be held until it was desired to remove it, without interfering with either navigation or summer travel, of which there is comparatively little on this part of the lake. All logs and timber should be in this large storage boom or down the stream in the spring before the summer travel on the lakes commences. A mill located here would be far enough away from the common routes not to annoy summer tourists, who might mistakenly be opposed to conservative lumbering, and would still be within easy reach of those who were interested in seeing how the work was being carried on.

The highway running from Browns Tract Ponds to this point on Raquette Lake has been practically abandoned as a wagon road, and for a considerable distance could be utilized for the track bed of the railroad without much cutting. The timber that stood on the right of way along this proposed route has already been cut for a portion of the distance, as it was at first intended to bring the main railroad track to the lake at this point. This was not done because the present route shortens the steamboat run to Marion River, making a quicker connection with the Blue Mountain Lake region. To



BRANCH RAILROAD AND



LAQUETTE LAKE.



VIEW OF LAKE, NEAR FORKED LAKE.



VIEW OF LAKE, NEAR FORKED LAKE, BY FLOODING.

no other suitable bay on the lake could a spur be constructed with so little damage to the forest as to this. A large boomed storage area here would not be exposed to the usual danger of having booms cut or opened by guides and tourists traveling by water, as there is no connecting water route into this bay. This would not be the case if it were attempted to store logs near the present railroad station, as that location is on a long-used water thoroughfare between Raquette Lake and the Fulton Chain, up Browns Tract Inlet. Again, the coming of all passenger steamers and launches on the lake to the present railroad station and steamboat wharf several times a day, coupled with the fact that there is not room enough in the bay to accommodate both branches of business satisfactorily, is an additional reason why that location would be undesirable. Sucker Brook Bay is much nearer to the middle of the lake and of the township than the present station, and if it were selected as the terminus of a spur track long towing by steamboat from a large portion of the tract would be avoided.

There are many reasons why it would be advisable to allow the erection of a mill at the point shown if a satisfactory bidder could be secured to undertake it. It would open a means of manufacturing into shingles much of the refuse Pine and Cedar which it would hardly pay to ship or drive to other markets in the log. If this Pine and Cedar could be manufactured near the lake, the slight expenditure necessary to bring it to the mill would be warranted. There would be a great many Pine butts and tops and broken pieces of Pine which could be made into shingles. There are also at present on the tract many Pine trees that have been cut or blown down and shaved shingles manufactured from a small portion of the butt. The remainder of these trees has been left in the woods and could in most cases be sawed into excellent shingles. It should be utilized in this manner and sold at a reduced stumpage rate, if only for the purpose of removing the trees, which now not only increase the danger from fire; but entirely prevent reproduction on the space they occupy and are almost indestructible by decay.

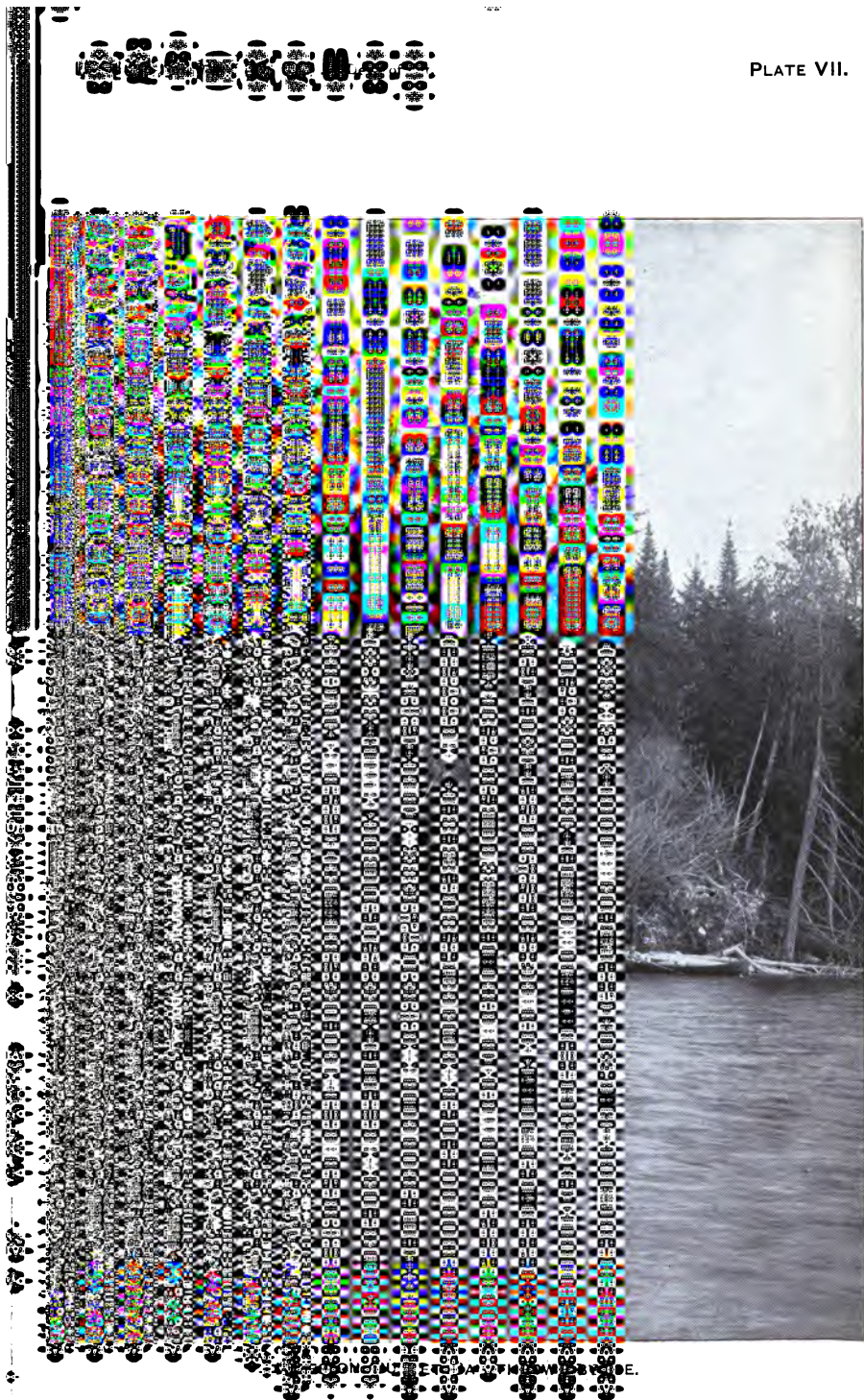
Around the shores of the various inlets of the lake—more especially along Marion River and Browns Tract Inlet—there is a large amount of dead Cedar which has been killed by the water having been held at too high a point in the summer. The effect of this is shown in Pl. VI, fig. 2. This Cedar could be utilized for shingles, fence posts, rails, and telegraph poles. It might be sold at a reduced rate in the same way as the refuse Pine. It is not likely that it would bring a very large price, but it should be sold with the provision that the trees be cut very close to the ground and that all the tops and branches be burned during the winter, or when there is no danger from fire. There is a considerable amount of Cedar on the tract which could be sold, and there would probably be a market opened for it if the erection of a mill were allowed.

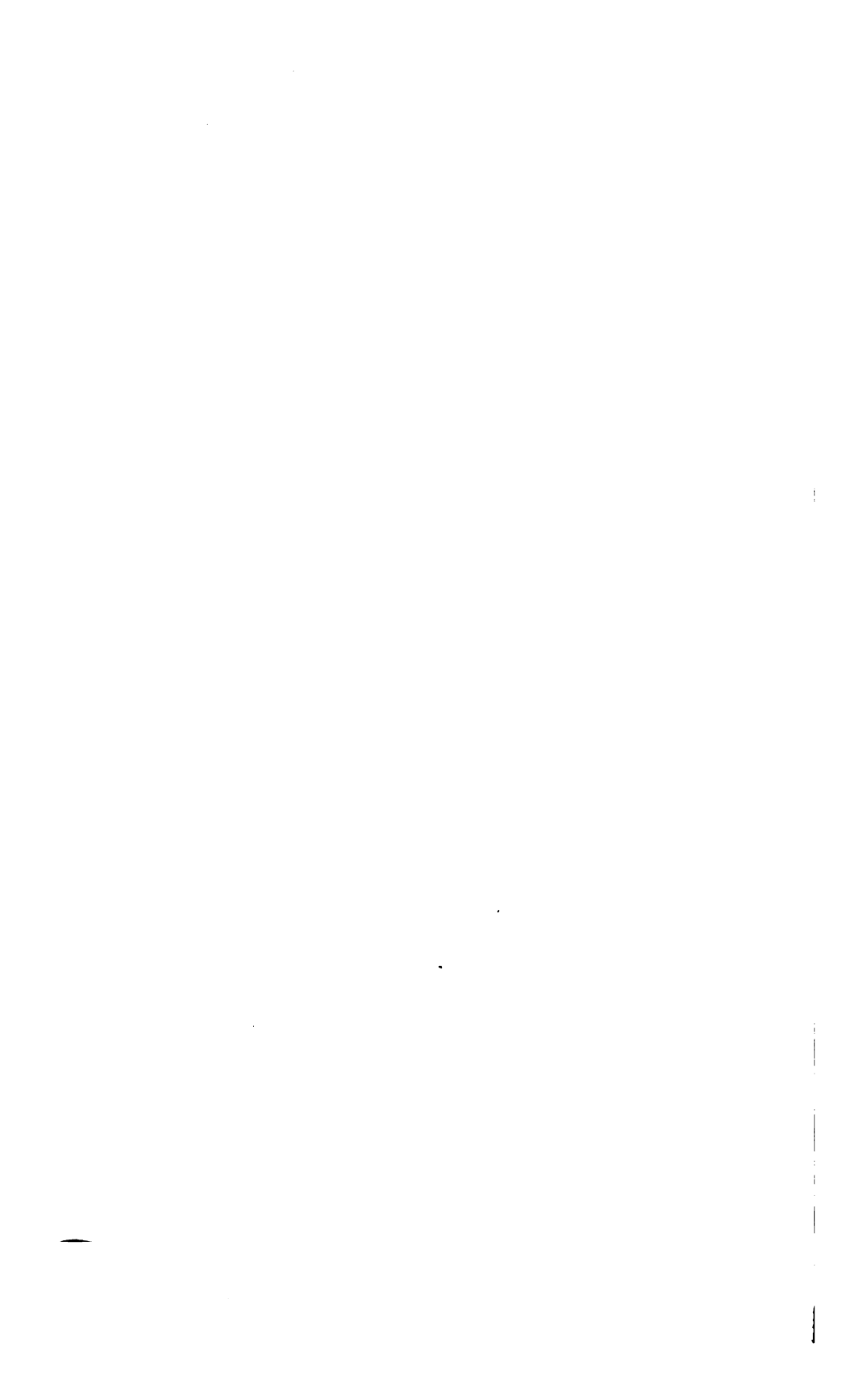
If the right to construct a mill and a spur from the main railroad line were granted, those who did not own a mill but who were desirous of purchasing the stumpage could continue their lumbering, even if the millmen and manufacturers attempted to form a combine to keep prices down. They could hold the timber in a large storage boom at this point until they had received a fair offer for it, since it could be shipped at any season of the year when the lake was free from ice; or, with the concession advised, if there were no possibility of their selling it in the unmanufactured state, they would have the opportunity to erect a small mill and to manufacture their logs into lumber. The advantage of having these different ways of disposing of the timber can hardly be appreciated by those without actual experience in lumbering and without knowledge of the difficulties which are oftentimes encountered from unexpected sources. These concessions would undoubtedly have a marked effect on the stumpage prices offered. There would be no danger to the owner of getting his logs hung up in a log drive as a result of low water, drought, or other causes, and of being compelled to lose materially by his failure to deliver the timber at a certain time, since the water is of sufficient depth at this point to permit of logs being floated to a mill slide or steam jack works without being raised above its natural level. The shore at the place shown on the map as a proposed mill site is of a firm, sandy soil. It would admit of easy grading, and could be quickly and cheaply brought into proper condition for erecting a mill, for the necessary side tracks for holding cars, and for piling ground for lumber.

It will be seen by a glance at Map III that there is a large amount of timber on Township 40 which would come naturally to this bay. This would include all the timber from the Cranberry Pond district and the south side of West Mountain, as well as all from Compartment No. VI and the Otter Pond country.

That portion of the timber tributary to Beaver Brook could also be hauled directly into this storage boom without towing by steamboat, as there is a swamp running from the south end of Sucker Brook Bay through to where Beaver Brook comes into the lake (see Map III), and there is no grade between these two points. In case it should eventually be decided to allow the timber on Township 41 to be cut, there is a heavy stand throughout that area tributary to Cranberry Pond, Shallow Lake, Pelcher Pond, and Queer Lake, all of which could be driven down directly into the storage boom if some improvements in the stream were made. All timber coming into Boulder Brook Bay, Stillman Bay, and Outlet Bay could be quickly and easily towed across the lake when the wind was favorable, and the only timber that would require any long towing by steamboat would be the comparatively small amount in Compartment No. IV.

The construction of the spur track would be necessary if it were





decided to sell the hardwood stumpage and allow the timber to be manufactured in a mill erected on the township, or to ship the logs out, as this is a central point. The map shows that back of each of the points or peninsulas, except Woods Point, there is a depression or swamp running through from one bay to another, which is low enough not to interfere with the hauling of logs across the peninsula, thus obviating the necessity of going around the points. This condition rarely exists, and forms one of the natural advantages of the township for lumbering purposes. This would not be of so much importance in softwood lumbering, but would be a great advantage in the case of hardwoods, since they will not float a long distance, and must be hauled by team to a place where they can be loaded upon cars or be manufactured. The fact that they could be hauled directly across these points from one bay to another would shorten the haul very materially, and consequently save a large amount of money. The possibility of having roads cross these points through swamps, which would protect them from the drifting snows invariably found on a lake road, is also a decided advantage.

If it should eventually be decided to sell the Hemlock bark and logs, this would be the most convenient center from which to ship the bark to market in cars. The bay is protected by small, well-timbered ridges, which would serve as breaks against the prevailing wind. The effect of wind on the shores in the spring is shown by a view taken near the Outlet. The trees were overturned by an ice pack, which was driven in large masses into this bay by the strong south and west winds. These usually prevail during the early spring, when the ice is breaking up, and through the early summer, at a time when log driving is generally being carried on. The result shown in Pl. VII was noticed only in places where the south and west wind strikes the shore. The only objection, from a lumberman's standpoint, to the location of a mill at Sucker Brook Bay, is that the prevailing wind is from the south and west and would tend to hold the logs offshore. But this objection is more than counterbalanced by the many other points in favor of this place, and the timber can be held inshore without large expense by the use of lever winches and kedges. The prevailing wind is an important consideration in choosing the location of a mill on any lake. On this lake, however, there is no choice except to take the most suitable bay on the side nearest the railroad, and the one recommended seems to be the best possible from all points of view.

RECOMMENDATIONS FOR A DAM AT THE FOOT OF RAQUETTE LAKE.

A permanent dam should be constructed at the foot of Raquette Lake, with suitable sluices for logs and properly constructed wastegates for keeping the water at a uniform height on the lake during the summer season, and also for driving logs from this lake into

Forked Lake in the spring, if desired. The dam should be built at a point about 500 feet below the present combined dam and bridge, at or near the point shown on Map III. The existing dam should be removed entirely, and the highway which at present crosses on top of it should be made to cross over the proposed dam. If it is to be built of wood, the work should be done at once, before the Pine timber on Township 35 is removed, since this is the most accessible for the purpose, and there is a heavy stand near the proposed location which could probably be secured now at a reasonable price. As the timber rights were reserved when the south half of Township 35 was sold to the State, it is quite probable that this timber will be removed within two or three years.

The control of the water in Raquette Lake should be placed entirely in the hands of a State official, since unless this is done there are many interests which will conflict. Such a conflict would be lessened by the building of a properly constructed dam and the regulation of the flow of the water with impartiality and discretion. There have already been many thousand dollars appropriated by the State at various times for the purpose of improving the Raquette River from Potsdam to its source in Hamilton County (see Report of the New York State Forest Commission, 1893, Volume II), but so far as has been learned none of the money has ever been expended upon the stream above Long Lake.

The stream between Long Lake and Forked Lake has been improved by private lumbermen, so that it is now possible to drive logs north from Forked Lake. There are still some rapids between Forked and Raquette lakes in which are many large boulders which would have to be removed, and there should also be some side piers built in the stream at different places, more especially one at the island midway between the two lakes, for the purpose of confining the stream to one channel. There is also a large amount of driftwood jammed at different points on the rapids, the accumulation of spring freshets for years, that would have to be removed before it would be possible to drive any of the timber belonging to the State above this point down to the natural water markets below. With a dam properly constructed the water could be held overnight or until a certain height was reached. Then, when the water was released, the logs and timber could be sluiced through very rapidly until the water in the lake was lowered to a certain point, when the dam should be closed. When the water in the lake had again reached the specified height the sluicing could be repeated until the timber that was to be delivered downstream was run through, after which the water could be maintained at a steady level on the lake above during the summer months, using the same dam for both purposes. Thus the use of the proposed dam would not raise the water in the lake any higher than the present dam. The logs would be driven by temporarily lowering the water.

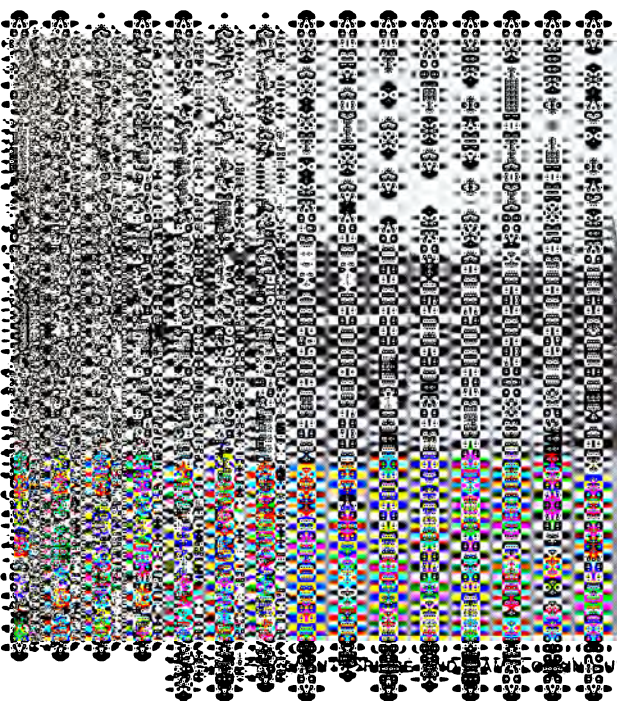
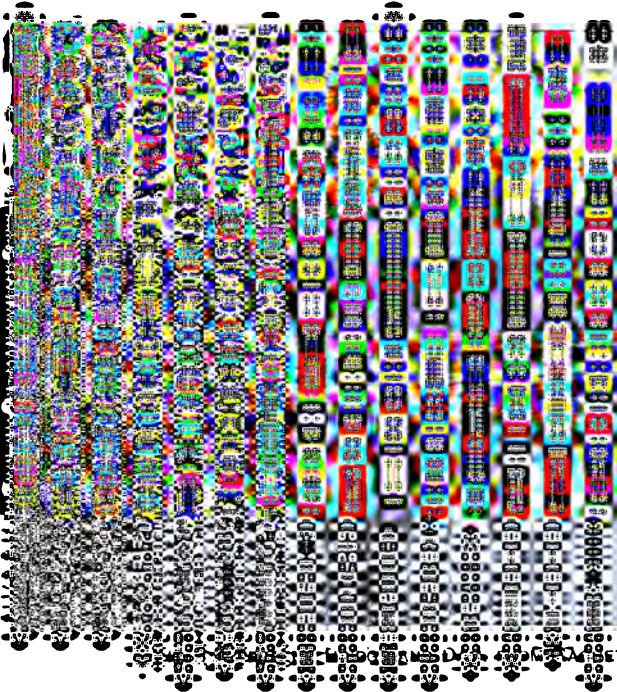


LAKE.



UPSTREAM.

PLATE VIII.



The occasional lowering of the water necessary to drive the logs should be over early in the spring, before tourist travel had begun, and the lake could remain at its normal level throughout the summer. These requirements can not be satisfactorily fulfilled by the present dam, which evidently was intended only to maintain the water at a suitable height to facilitate steamboat navigation on Raquette Lake, Marion River, and South Inlet. The level of the water in Raquette Lake is at present controlled entirely by the steamboat company.

Steamboat navigation on the lake above would not be interfered with by the adoption of the proposed method of regulating the use of water for log driving. It would not be necessary to raise the water above the high-water mark on Raquette Lake, nor to cause any serious damage to property on the shore. It would be necessary, however, to build a suitable dam at the point shown and to remove the present combined bridge and dam, as it is built at a point where the stream is wide and shallow and will not allow the release of sufficient water to properly flush the stream for driving below, unless the planks which are set up against the upper side of the bridge for the purpose of closing the dam are removed for a considerable distance from along the present bridge front. When the water is at ordinary height, there is not sufficient depth to carry timber through the present dam. And when the high water of the spring freshets swells the stream to a proper driving depth the logs would strike the bridge roadway stringers, for the bottom of the bridge stringers is only $4\frac{1}{2}$ feet above the top of the sluice, and unless the water is just at a certain height, logs can not go through. The stringers could, of course, be raised in the spring for the purpose of sluicing logs, if there were no other objections to the present dam; but this is only one of the minor reasons why it would not satisfactorily serve the double purpose of driving logs or timber out of the lake in the spring and maintaining the water at a steady level in summer. At the time the photographs shown in Pl. VIII, figs. 1 and 2, were taken, there were only 10 inches of water above the sluice floor.

The site recommended for the dam is shown in Pl. IX, figs. 1 and 2, and is the best location available. The bed of the stream is narrowed here, and there are good, high banks, especially on the south side. This is the nearest point to the lake at which a dam can be built entirely on State land, as the dividing line between the State land and private holdings in Township 35 runs across the combined dam and bridge now in use and clears this location by about 100 feet on the north side of the stream. A dam 12 feet high built here would have its top exactly level with the top of the present dam, and would raise the lake when full of water to just the same level. This level is shown by the white flag on the pole in Pl. IX, fig. 1. The location of the proposed dam, the original bridge piers, and in the distance the present bridge and dam, are clearly shown in Pl. IX, fig. 2.

There are several short sets of rapids between this point and Forked Lake similar to those already shown. The building of a dam here and the removal of the obstructions above—the old bridge piers and the present dam and large boulders—would allow the water to be discharged, through properly constructed sluices, with a sufficient head above it to give the required pressure to flush the stream below, and would furnish a sufficient depth in the sluices to carry timber through the dam when there was water enough in the stream to float it away. The removal of the present dam and other obstructions would allow the water to flow evenly and steadily over the wide and shallow portion of the Outlet where the present dam is located, and while furnishing a sufficient depth to float timber down to the dam, the added width of unobstructed flow would serve to keep the deeper and more narrow sluiceway below filled with water, according to the height and pressure of the water from the lake above.

The prevailing wind would be a decided advantage in driving logs from the lake downstream, as it would aid in moving them to the Outlet and holding them down to the sluicing booms. There is a large boulder which stands out of the water in Outlet Bay at the point shown on Map III, which would furnish an excellent boom-stay for the purpose of holding the logs down the Outlet, if desired. Booms could be hung to this rock by drilling a hole in it and using a large iron split plug and wedge with a ring in the plug. The booms could be opened on one side, or both, as the case might require. These are some of the many natural advantages for lumbering this township. It is not considered necessary to mention all of them in detail. They will be readily apparent to the experienced lumberman.

The erection of a dam at the place proposed would raise the water above it, so that a large number of the rocks and boulders, which are seen below the present dam in Pl. X, fig. 1, would be covered by the back flow, and but few of them would need to be removed.

Unless this stream were improved and the right granted to drive timber from this lake to Forked Lake under certain restrictions, the lumbermen, manufacturers, and mill owners on the stream below would be practically barred from competitive bidding on the timber above this point, and such competition would be necessary in order to get the highest possible price for the timber.

According to the estimated stand of timber on Township 40, there are 410,263 standards of Spruce, Pine, and Balsam which it will be advisable to cut. If the Hemlock 14 inches and above at breastheight were included, there would be 544,526 standards on this township alone. An advance of 1 cent per standard on the stumpage price would realize to the State more than enough to cover the cost of making the proposed river improvements. The timber on this township alone would undoubtedly sell for at least 5 cents more per standard, or approximately 25 cents per 1,000 feet B. M., with a water outlet to market assured, than it would if confined to a single outlet, and that a



ORIGINAL BRIDGE PIERS.



BELOW.

Ground.





...ING DOWNSTREAM.



...SITE.

... on the right bank.



railroad. In the latter case, too, exorbitant and arbitrary transportation rates could be maintained if the railroad were inclined to do so, as it would have no fear of competition. The effect on the stumpage value of this timber of having two outlets would be very important.

On Townships 6, 5, and 41, after all private holdings have been deducted, there remain about 70,000 acres of land belonging to the State, from which the timber, in addition to that on Township 40, could come to this lake. If this land should yield the same average amount of Spruce, Pine, and Balsam per acre as estimated for Township 40, there would be 1,700,000 standards to add to the estimated 410,000 standards on Township 40. This would mean 2,110,000 standards of Spruce, Pine, and Balsam on the four townships. If the Hemlock were included on the same basis there would be about 2,800,000 standards of timber so located that they could be brought to this lake center, not including any of the Cedar.

Four thousand dollars would certainly cover the cost of all the necessary improvements, besides paying for all the timber and material needed for the construction of a wooden dam.

The small cost of the proposed improvements, when compared with the probable gain by the increased value of the stumpage, makes their construction imperative from a business standpoint. Each advance of 1 cent per standard on the stumpage on the four townships would mean a gain of about \$28,000. There is no question but that the stumpage price would be very materially advanced by having two outlets and by the consequent rivalry in bidding.

STUMPAGE VALUES OF SPECIES TO BE REMOVED.

The prices of stumpage vary greatly according to the location of a tract, the topography, and the stand of timber. From the standpoint of the forester not less than of the lumberman, the prices that may reasonably be expected for the stumpage on Township 40 require consideration.

What the lumberman can afford to pay depends upon several conditions, all affecting the final question of what it will cost to deliver the timber to the markets. The market price is the basis of the stumpage price, and the cost of getting the timber to the market regulates the scale of prices. For example, if the timber were worth at the mill \$1.50 per standard, and the cost of delivery were \$1, the stumpage price that could be paid would be 50 cents. If the timber could be delivered for 90 cents, the stumpage price would be 60 cents. The conditions which govern the lumbering of a tract regulate the stumpage prices. If a tract is very rough and precipitous with a small stand of timber, a long haul to water, and then a long and costly log drive before reaching market, the stumpage price would be lower than if the tract were comparatively smooth, with good skidding ground, a large stand of timber, short haul, and cheap log driving.

Market and consequently stumpage prices of Spruce and Pine in the Adirondacks have been steadily rising for some time, and especially of Spruce, because of the increased demand for Spruce pulp-wood. The increasing scarcity of timber lands, except those which are owned by the State or large corporations and those in private preserves, will likewise tend to maintain prices. As the growing scarcity of timber becomes apparent, millmen and manufacturers are vying with the State in getting hold of valuable timber lands, and of late there have been large investments in forest lands in the Adirondacks.

Township 40 is so favorably located for lumbering cheaply that the State would be justified in expecting the highest stumpage prices that are being paid locally at the time it is lumbered.

It was at first intended to furnish a complete list of railroad transportation rates to different markets in connection with the probable cost of lumbering each compartment in the township separately, this cost having a direct bearing upon the stumpage prices which could be expected. But it was found impossible to get satisfactory rates on something that might or might not be done in the future. As prices are constantly fluctuating, and as conditions which exist at present might be radically changed before it was decided to cut the timber on the tract, it was deemed better simply to quote the prices that could reasonably be expected for the stumpage at the present time.

The price of Spruce stumpage at present ranges from 40 to 55 cents per 19-inch standard, and should include the Balsam at the rate of 15 per cent of the Spruce. Letters received from many pulp manufacturers show that Balsam can be used in this ratio with satisfactory results. Balsam has long been included with Spruce stumpage under the same price, as should be done on this tract, cutting to the limits advised. In disposing of stumpage it is the usual custom to sell Spruce, Pine, and Balsam combined (sometimes including Hemlock and Cedar), these being the soft timbers which are commonly lumbered together in the Adirondacks. Pine stumpage is the most valuable and Balsam the least so, with Spruce between them. If there were an equal amount of each on the tract it would be fair to include them both with Spruce and let the Spruce price govern the whole. There is practically no market for Balsam unless sold with Spruce.

If the stumpage of Spruce, Balsam, and Pine were sold together on Compartment No. I at the present, it would probably bring 60 cents per 19-inch standard, as there is nothing to prevent this timber from being driven direct to markets downstream, and the stands of Pine and Balsam of the diameter limits advised for cutting are about equal on this compartment. (See Table No. 24.) There is a good log road already constructed from the point at which Brandreth Lake Outlet enters Township 40 down to Forked Lake. (See Map III.) This would add to the value of the stumpage by lessening the cost of the lumbering. It is quite likely that the State would be able to obtain 55 cents per standard for all the Spruce, Pine, and Balsam timber on

the whole tract, sold together, if the improvements and concessions advised were made. But it must be remembered that prices are fluctuating, and that these estimates are good only for present conditions.

RULES FOR LUMBERING.

The application of the following rules will insure the safety of the forest. Its function in preserving the water-supply and as a public recreation ground will not be impaired by conservative lumbering, while its capacity as a producer of timber will be steadily increased.

In order to be certain that no timber below the advised limit for the different species is removed, and also in order to designate the trees so that there will be no possibility of the lumberman misunderstanding which trees he should cut and which he should not cut, it will be necessary to mark all trees intended for removal.

The diameter limits advised have been fixed after a thorough study of the effect of the cuttings upon the forest and the profits to be realized from the lumbering. Upon the care with which the markings are made and rules carried out the success of practical forestry upon Township 40 chiefly depends.

As has been stated (p. 33), smaller trees which show unmistakable signs of decay and death, but are still merchantable, or of which the tops have been broken off by falling trees or wind storms, so that it is clearly apparent that they will not live, should also be marked for removal.

Spruce, Pine, or Balsam trees, whose branches are so interlocked with valuable hardwoods or Hemlocks that they can not be removed without cutting the latter, should not be marked. They can be taken when the other species are marketed.

METHOD OF MARKING TIMBER FOR REMOVAL.

The method of marking trees adopted by the Division of Forestry is to blaze the butt of each tree intended for removal below the cutting point on the stump, with a hatchet, and to stamp the spot with the hatchet head, on which the initials "U. S." are raised. This symbol may, of course, be changed for State work. The marks on the stump will make it possible to determine afterwards whether any trees intended for removal were left, and also whether any were taken which were not intended for removal. The markers should brand all trees that are to be cut. It has been found that in marking timber the most satisfactory results can be obtained with a crew of three men. The usual custom is to take a strip through the forest, the men keeping abreast within easy speaking range of each other, marking every tree between them which is to be removed, and watching each other to see that no trees of the proposed limit or above are overlooked. The inside man follows the line of marks already made, and the others are guided by him. The man on the side next to the forest

which has not been marked spots a hardwood tree occasionally, where there is not sufficient marked timber to serve as a returning guide line. It is estimated that a crew of three men can mark from 40 to 60 acres a day. The cost of marking on this tract should not exceed 15 cents per acre.

METHOD OF CUTTING.

There are but two methods of cutting timber in common use—chopping and sawing. Since sawing saves much timber which is necessarily wasted by chopping, it is strongly recommended for Township 40. It will be apparent even to those who are entirely unacquainted with lumbering methods that a tree felled and cut up with a saw yields more lumber than one cut with an ax. The kerf chopped out with the ax causes a loss in length of approximately one-half the diameter on the butt of each log. This being usually the best part of the log, it is very advisable to save it. For an illustration of the difference between the two methods of cutting see Pl. XI. What this difference would mean on this tract, on the Spruce alone, is approximately as follows: The average Spruce tree 12 inches and over at breastheight on Township 40 yields 1.26 standards if cut with the saw, as shown in Pl. XI, fig. 1. If cut with the ax, as in Pl. XI, fig. 2, it would yield only 1.19 standards, a loss of 0.07 of a standard per tree. If we assume that the total merchantable stand of 328,287 standards is contained in 260,545 trees with an average contents of 1.26 standards per tree if cut with the saw, then a loss of 0.07 standards per tree by chopping would mean a total loss of 18,238 standards for the whole tract. At 50 cents per standard this loss would reach \$9,119. A greater number of cuts, made by cutting the timber in shorter lengths, would increase the loss proportionately.

It is the usual custom in cutting Spruce logs intended for pulpwood to cut them 14 feet 4 inches long. Each log then makes seven 2-foot lengths of pulpwood, when cut up before "rossing." The four additional inches are to cover the necessary loss in cutting up and in trimming off the battered, discolored, and damaged ends of the logs, caused by driving them through rapids and over falls, and by their lying in the water until taken out for manufacture. If the logs were to be manufactured at Raquette Lake, 2 inches, or at the most 3, would cover all trimming, as the logs would not have to be driven through rapids or over large falls. An extra 4 inches, however, should be allowed on this tract for the lengths to which the softwoods are usually cut—10, 12, 13, or 14 feet, and also 16 feet when it is for the purpose of saving timber by bringing the cutting point in the top to the prescribed limit. This can always be done by varying the length of the log on the foregoing length scale. To allow any longer lengths than these to be scaled at the top end would cause a loss to the State, on account of the decrease in diameter as compared with timber cut 13 feet—the length upon which the scale rule advised is based. But if the timber were cut into 10- to 16-foot lengths, and the quantities

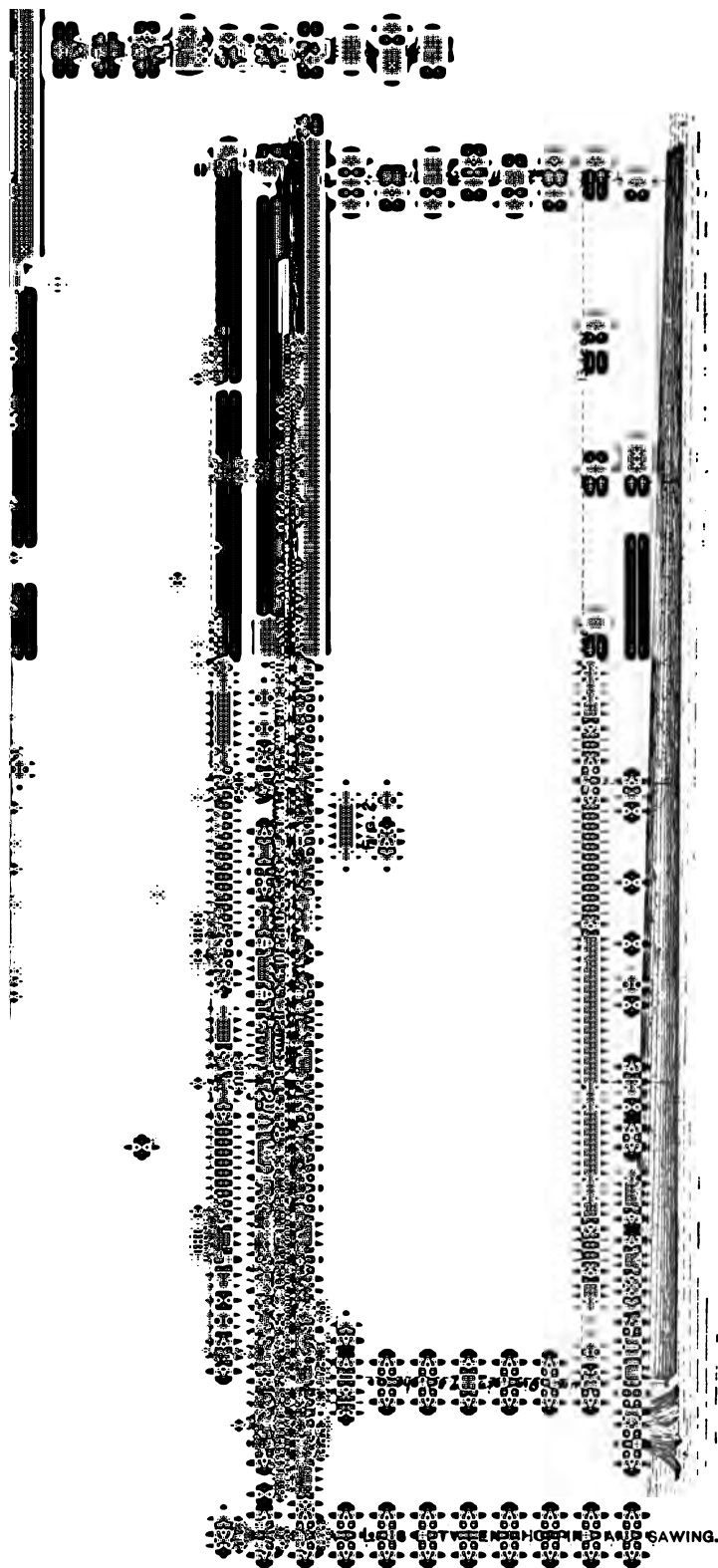


Fig. 1.



above and below the 13-foot standard length balanced, there would be no appreciable loss.

HEIGHT OF STUMP.

It is always important in lumbering to cut at the lowest point practicable. The timber in the butt is almost invariably of the first quality. It is clear and free from knots, and, if sound in the heart, is actually worth more to the manufacturer than any other portion. Very frequently the cutting of the tree at the lowest point practicable will considerably increase the scale allowed for the whole tree, because the slight difference either way in the height of the stump increases or decreases the diameter at the top of the logs. In the Adirondacks logs are scaled in even inches. Fractions of an inch below one-half are dropped, while any above are considered whole inches. Very often the diameter of a log is so near the one-half-inch point that the increase gained by cutting low is enough to put the log into the next higher inch class. These apparently slight differences in scale may at first glance seem of little importance, but in reality they can make or mar the profits of the average lumber job.

In verification of the above, we cite results of experimental measurements made in 1897 by Henry S. Graves, now Director of the Yale Forest School, and published by the Division of Forestry in Bulletin No. 26, entitled "Practical Forestry in the Adirondacks," page 59:

Two hundred and eighty-three trees, which were measured in Nehasane Park in 1897, were scaled in standards. The taper of each log in each tree was computed, and it was determined what the diameter at the top of each would have been if the stump had been cut 18 inches above the ground.

It was found that out of these 283 trees 78 would have actually scaled more in standards if low stumps had been cut. Computation was made of the percentage of increase in each tree affected, and of the ratio of trees of each diameter showing an increase to the entire number measured.

The total increase for all the trees amounted to 5.4 standards. The total yield of the trees was 258 standards. The percentage of increase was, therefore, 2.1. The trees from which this computation was made were all sound. In actual practice a number of the trees are found to have some imperfection at the stump and a short piece has to be cut off. In generalizing from the above figures, therefore, an allowance should be made for trees of this character. It is believed that a reduction of 5 per cent is ample. The figure 2.1 per cent should be, therefore, 2 per cent.

These figures mean that for every 100,000 standards removed, 2,000 are wasted by cutting high stumps. If a tract of 100,000 acres yields on an average 15 standards per acre there would be a loss in cutting high stumps of 30,000 standards. At a stumpage value of 40 cents per standard this represents an actual loss of \$12,000.

If these figures were applied to Township 40, on which there are 410,263 standards of the species advised for removal, the saving would be, at a stumpage price of 50 cents per standard, \$4,102.63.

It is claimed by some lumbermen that the cutting of high stumps economizes in the time and labor expended in the "butting," or cutting off, of that portion of the tree which is sometimes affected by heart rot,

shakes, or other defects. But the tree can very seldom be cut high enough to remove these defects when found, and another cutting usually has to be made, and sometimes two or three, before the proper point to remove the defect is reached. It is impossible to judge with absolute certainty, from outside appearances, what the condition at the heart is, especially with regard to Spruce, and the foregoing theory could hold good only on very slightly affected trees, while all sound trees cut in this manner would be cut at a very appreciable loss. A foot in length saved of the clear timber in the butt of the tree, where the cutting-point diameter runs from 14 to 30 inches, as it does with the Spruce on this tract, is worth several feet in the top of the tree. There is not only the difference in the increased scale of the butt, but also the difference of the two extremes of quality—the clearest and best timber in the butt, and the smallest and most knotty in the top.

The cutting point can not be arbitrarily fixed for all conditions. Locality and the position of the trees with reference to large rocks, fallen trees, or other obstacles, tend to make this impossible. But it is recommended that no cutting more than 6 inches above the top of the root swelling be allowed.

DIAMETER LIMIT AT TOP END.

The following table, obtained by very careful measurements of 1,064 Spruce, shows in standards by Dimick's Rule how slight is the difference in scale of the top log gained by cutting to a diameter limit at the top end of 4 or 5 inches rather than 6 inches.

TABLE NO. 27.—*Difference in scale between cutting the top log to 4 or 5 inches and to 6 inches at the top end.*

| Diameter breasthigh. | Number of trees analyzed. | Total gain by cutting to 5 inches rather than to 6 inches. | Average gain per tree. | Total gain by cutting to 4 inches rather than to 6 inches. | Average gain per tree. | Average number of trees per acre. |
|----------------------|---------------------------|--|------------------------|--|------------------------|-----------------------------------|
| <i>Inches.</i> | | <i>Standards.</i> | <i>Standards.</i> | <i>Standards.</i> | <i>Standards.</i> | |
| 10 and over..... | 1,064 | 3.39 | 0.003 | 4.06 | 0.004 | 23.40 |
| 12 and over..... | 883 | 2.16 | .002 | 2.52 | .003 | 15.56 |
| 14 and over..... | 602 | .44 | .001 | .26 | .0004 | 9.95 |

The average gain in the top log per tree 12 inches and over cut to 5 inches at the top end instead of to 6 inches is 0.002 standards. There is an average stand of 15.56 trees, 12 inches and over, per acre on Township 40. The gain per acre, cutting to 5 inches instead of to 6 inches, would therefore be 0.03112 standards. For the whole area of 16,896 acres this gain would be 525.80 standards, or only sixteen-hundredths of one per cent of the total yield of Spruce cutting to 6 inches.

It is true that if the purchaser of stumpage were to manufacture his own timber, the value to him of the additional material which the smaller limit would yield would be greater than the table indicates. But if the timber is sold by scale, as advised in this working plan, there would be no appreciable gain to the owner of the timber, though the forest would benefit by the removal of so much more of the objectionable tops. Further, all log buyers and dealers in pulp-wood object very strongly to any smaller diameter than 6 inches. With a diameter of 12 inches at breastheight, the top at 6 inches is sure to be about as far up in the limbs as the tree will have any commercial value, even for pulp-wood.

For these reasons it is advised that the Spruce and Balsam timber on this township be cut to a 6-inch limit. But it should be plainly understood that a 6-inch limit on Spruce means that the timber shall be actually cut to 6 inches in the top, and not cut to 7 or 8, as is usually the case, unless there should be some very satisfactory reason therefor. Should any timber over 6 inches in diameter at the small end, long enough to yield a 4-foot stick of pulp-wood, be left in the top, it should be scaled double as a penalty for not taking it at first. The length of the top logs can be varied by cutting them off at 10-, 12-, 14-, or 16-foot lengths, to bring the cutting point in the tops to the desired place on the trees. The tops might be cut to any smaller diameter by the contractor if he desired, but, if cut smaller than the limit, should be scaled at the limit. For example, if a Spruce log be cut to 5 inches at the top end, 16 feet long, it should be taken as a 6-inch log. This rule should be applied to the diameter limit on Pine, as far as practicable. A 10-inch limit at the top end is advised for the Pine. Pine logs are not considered merchantable timber, in the generally accepted sense of the word, when cut shorter than 10 feet in length and 10 inches in diameter at the top end. It will therefore be necessary in cutting the Pine to allow the lumberman to cut the logs into 10-, 12-, 14-, or 16-foot lengths, as the particular tree being cut may require. In order to save timber, every Pine tree should be measured to the required diameter limit at the top before a log is sawed off, and the length of the different logs should be varied on the above-mentioned lengths to bring the cutting point of the top log to the required diameter limit in the top of the tree. By so doing, much valuable timber would be saved, and if there were any visible defects in the tree they would be found before the cutting up commences and the lengths could be varied to remove them.

CARE IN FELLING, SKIDDING, AND IN CUTTING ROADS.

It is easily possible to save a large amount of the smaller growth on this tract by the exercise of a little care to fell the timber properly, and not to break down the smaller trees when it could as well be

avoided by throwing the tree in the direction where there are the least number, or none, of the more valuable species growing. This should always be done when possible. The laying out of roads and skidways is another matter in which the exercise of reasonable care, while it means no extra cost to the lumberman, would accomplish a great deal in the preservation of the young growth. Many lumbermen make a very serious mistake by cutting too many roads for the area to be lumbered. They lose not only the cost of cutting out and leveling the roads preparatory to lumbering, but also that of clearing out for more skidways than are needed and of breaking out and fitting up more roads in the winter than are necessary for hauling. A winter of deep snows entails a consequent expense of shoveling the snow from the front and off the top of a large number of unnecessary skidways. These are not small items under certain conditions, as many lumbermen have found out to their sorrow.

Much unnecessary cutting and clearing out incident to making too many roads and skidways can be avoided by a careful location of the main roads and the building of no more branch roads than are absolutely necessary to reach the timber without skidding the logs too far, and also by building fewer and consequently larger skidways, whenever practicable, rather than many small ones. It is impossible to make a set rule for the distance logs should be skidded or the number of roads to be cut, both varying greatly with difference in topography. The proper location of roads should come under the direct supervision of the inspector in charge of the work, in whose hands, if he is competent for the position, these details may be safely left.

USE OF TIMBER FOR SKIDS, CORDUROY, AND BRIDGES.

In building skidways, corduroys, and bridges, the smaller hardwoods should always be used whenever it is practicable. Where there is no hardwood near by, the Balsam will almost invariably be found in sufficient quantity. Whenever possible one of these should be used for this work.

In building skidways, it has been found practicable and economical at times to cut from the trees intended for logs sticks of 2 or 3 log-lengths, as the holding capacity of the skidway may require, and to use them for skids until the logs are hauled off them in the winter. They should afterwards be cut into the proper lengths and hauled with the other logs. On account of the large diameter limit here advised for the cutting, it would be advisable to use that part of the tree nearest the top for this purpose, since it is lighter and easier to handle. At the same time it should be remembered that there is a decided advantage in using large, heavy skids, since, although it takes a little more time to get them into position, they do not require as much blocking up to raise them to the proper height in front, and the danger of the breaking down of a large skidway, after all the logs are carefully rolled upon it, is removed. The use of small Spruce for

building skidways, corduroys, and bridges should not be allowed, unless it is impossible to find other timber of less value within a reasonable distance, a condition very seldom found in the Adirondacks. If small Spruce is used (except with the inspector's approval), it should be scaled at double value; for example, a stick 14 feet long and 6 inches at the top end should be scaled and charged against the person buying the stumpage as two such sticks. There should also be the distinct understanding that no smaller diameter limit than 6 inches will be figured, even on sticks of 4 inches in diameter, if cut from small trees without the consent of the inspector. This may seem at first glance a very hard rule to impose upon the lumberman; but a careful study of the conditions at present existing on all the lumbering operations that have been looked over makes it very evident that the inspector in charge of the proper lumbering of this tract should have a right of this kind. This is necessary in order to protect the State from the repeated small violations of the rules for lumbering, which, while hardly of enough consequence singly to warrant an open rupture or the breaking of the contract, would, if allowed to go on unchecked (as would be quite likely unless there was a small penalty of this kind which could be applied at once), very materially interfere with the proper lumbering of the tract. The enforcement of this rule would give the inspector in charge an opportunity to employ his own judgment in each case as to whether or not it were necessary to use small Spruce.

LOPPING TOPS.

There has been a great deal of discussion throughout the Adirondacks about the advisability of lopping tops when lumbering. Each side has its supporters. It is noticeable, however, that the owners of the land, and all who have a decided interest in the preservation of the forest, are usually in favor of lopping tops, while those who are opposed to it are almost certain to be either the persons who are compelled by contract or agreement to do the lopping, or some of their friends, who have taken the idea from them. There is no doubt that the proper lopping of tops is of great importance in the matter of checking forest fires. When the limbs are not lopped the tops are propped up from the ground by those underneath, and during a dry time in the early spring or summer, especially before the leaves are out, the small limbs and branches get exceedingly dry. If they catch fire in this condition they will burn very quickly, making a hot, flashy fire, especially when the tops are Spruce, Pine, Cedar, Hemlock, or Balsam. Where there are several tops lying together they will burn with a flash and roar that can be seen and heard for a considerable distance, often sending sheets of flame above the tops of small standing trees. These flames flash up through the branches of the resinous trees and usually set fire to them and kill them, while the added flame from the burning trees sets fire to the branches of others. When down tops are in this dry condition and are thickly spread over the ground

(as is usually the case when cutting to a small stump diameter limit) the fire will run from one top to another, especially if a strong wind is blowing, just as it runs through dry, dead grass of wild meadows in the spring or fall. Even in swamps, where the Cedar had been cut and the tops were lying thickly spread about, the fire, impelled by a strong wind, has been known to run across as quickly as a man could, although the ground under the tops was wet and springy and would not burn.

When the forest is dry it has been found by all woodsmen almost impossible to check entirely a forest fire until it has run out of the territory of old cuttings, dead and dry tops, and slashes, or until rain has fallen.

For these reasons it is strongly advised that all tops on this tract not wholly broken by the fall be thoroughly lopped, in order to bring them to the ground, or near enough to it so that the first winter's snow will crush them down completely. They will then soon become wet and soggy, decay will set in much more quickly, and they will not burn in ordinary summers. The danger of fire, the greatest danger to the forest from lumbering, will thus be very materially lessened.

The cost of lopping tops varies greatly under different conditions and on different jobs. It is usually from 2 to 3 cents per standard, according to the diameter limit to which the cutting has been made and the thoroughness with which the work is done. It will be readily seen that if the top were cut off at a diameter of 8 inches more branches would remain to be lopped than if it were cut to 6 inches. Consequently it costs more to lop tops for an 8-inch diameter limit than for a 6-inch. On the same principle, the larger the stump diameter limit the less lopping of tops per standard, as it costs no more to lop the top of a tree containing two or three standards than it does one containing only one standard after the 6-inch point is reached. Therefore the cost of lopping tops on this tract, if cut to a 12-inch diameter limit breasthigh (which is practically 14 inches on the stump at the cutting point), would be less per standard than if they were to be cut to a 10-inch diameter limit, as there would be a much smaller number of tops from which to cut the limbs. The cost should not be above 3 cents per standard, or 15 cents per 1,000 feet B. M., and the lopping should be thoroughly done for that sum.

A little care exercised in the proper felling of a tree makes a decided difference in the work of lopping tops. If the tops are lopped immediately after the tree is felled, before other trees are felled upon it, the work can be done much more cheaply and with more safety to the young growth than if the lopping is made a separate job to be done after the cutting is completed. Later there will be many slashes, the cleaning out of which will add materially to the cost of lopping.

METHODS PREFERABLE FOR CUTTING ROADS TO THE LAKE.

The logging roads to the lake should reach the water as near the backs of the bays and the mouths of the inlets as practicable. No

roads cut through the reserved strip along the lake front should be wider than is absolutely necessary to allow the passage of one loaded team at a time. No logs whatever should be skidded upon the shores of the lake. It would be impossible to allow the clearing out of a space large enough for the skidways and the consequent cutting of skidding roads and trails without causing more or less of an opening on the lake shore, which can just as well be avoided. Any roads which must be brought out at points where there are no streams coming into the lake should be made to come out to the lake with as short a curve as possible, and never in a straight line. The short curve will break the view of the cutting up the road, except for a very short distance, and will prevent it from being seen from the lake.

A little care in bringing out the roads properly and in keeping skidways away from the lake shores will prevent the lumbering from offending tourists and the summer traveling public, as well as the residents around the lake, who might not at first clearly understand its purpose and result. The proper arrangement of the shore end of the roads is as necessary to preserve the beauty of the landscape as the leaving of reserve strips along the lake shore.

SCALE RULE ADVISED.

Dimick's¹ 19-inch Standard Rule has been the basis for all estimates of the softwood timber on Township 40. This rule gives the contents of all logs in terms of a standard log, 13 feet long and 19 inches in diameter at the small end. The use of this rule in determining the amount of timber sold on Township 40 is strongly advised for the following reasons:

It is the rule best known and understood throughout the Adirondacks; and therefore it commends itself to the buyer and seller alike as a common scale which both parties understand perfectly. It is, in the opinion of a large majority of the lumbermen, millmen, manufacturers, jobbers, and contractors, the fairest rule for both buyer and seller.

A standard rule is preferred to a board foot rule in this case because most board foot rules give too small a scale to the small logs as compared with the larger ones. There will naturally be a large number of small logs in the tops of the trees on this tract, and as they bring, when sold with the larger ones, the same price per standard, it is advisable to use a rule which gives as nearly as possible the actual contents of the small as well as of the large logs. These requirements will be best served by the adoption of Dimick's Rule.

The Old Scribner Rule has been used in calculating the volume of the hardwood timber, because it is considered advisable to use a board foot rule for timber of this kind. This rule is more nearly accurate for the small logs than any of the others. It has been proved conclusively by manufacturers and millmen that neither the Dimick nor

¹Published by Crittenden & Cowles, Glens Falls, N. Y.

the Old Scribner allows more merchantable material for small logs than they actually contain.

METHOD OF SCALING.

The method of scaling advised for this tract is the one in common use under Dimick's Rule—viz, measuring the diameter at the top end of the log. Its use is recommended, however, with the following provisions:—No Spruce or Balsam logs should be measured at the top end if cut more than 14 feet long (unless to save timber on account of breakage, forks, or defects), except such top logs as may be cut 16 feet long to bring them to the required top diameter limit. Pine logs over 14 feet long should be measured at the top end only when cut 16 feet long to save timber on account of breakage, punk knots, forks, etc., or to bring the cutting point to the desired top diameter limit. Any timber cut for dimension stuff, booms, spiling, or building material should be scaled at each 13-foot length when practicable. To scale long timber at the top diameter is not just, and would cause a serious loss to the State. When the timber is in such a position that the 13-foot points are not accessible, as when piled in skidways, every log should be measured at each end and the average of the two measurements taken as the diameter, and from it the contents should be found. The customary rule of accepting the diameter of the logs at the nearest full inch above or below the actual diameter should be followed.

No Pine logs should be culled or left in the woods that would scale 50 per cent or over of sound merchantable timber. Such logs should be scaled and taken at their actual merchantable value, both the end area of sound merchantable timber and the length of the log being taken into consideration. This rule is necessary in order that the State may not be the loser by careless or inefficient cutting, because much timber is sometimes wasted by slovenly work, especially in Pine.

Merchantable Pine timber should be construed in this case to be any timber that will cut sound boards of the minimum length of 10 feet.

Spruce or Balsam logs should be scaled and taken at their actual merchantable value whenever they do not contain more than 25 per cent that will not make merchantable pulp-wood. The incorporation of this rule would largely do away with careless and wasteful methods of cutting the timber, since no lumberman would continue to haul and drive logs under conditions involving this loss of scale. The scalers should be in the employ of the State and the number should be determined by the amount of lumbering going on. They should be selected wholly with reference to their capability and reliability, and they should be directly responsible to the inspector in charge of the work.

RULES FOR LUMBERING TO BE EMBODIED IN THE CONTRACT.

It is advised that the following rules be incorporated in any contract made for lumbering on Township 40. As has already been said,

thorough supervision by trained men is absolutely essential to good results in the application of these rules:

1. All timber shall be cut with a saw whenever practicable.
2. No timber shall be cut in the reserved strips, except with the consent of the inspector.
3. All roads laid out through the reserved strips shall be approved by the inspector before any cutting is commenced.
4. No trees shall be cut which are not marked.
5. All trees marked shall be cut, unless a satisfactory reason is given for leaving them.
6. No trees containing merchantable timber shall be left lodged in the woods.
7. No trees shall be cut more than 6 inches above the swelling of the roots, unless a satisfactory reason is given.
8. All merchantable timber in the tree which is above the established diameter limit at the small end shall be utilized. If such timber is left, through carelessness or purposely, it shall be scaled double and charged at the stumpage rate paid for the timber.
9. No Spruce shall be used for bridges, corduroy, skids, slides, or for building camps or dams, unless the scarcity of less valuable timber makes its use absolutely necessary. Any timber unnecessarily so used shall be scaled double and charged at the stumpage rate.
10. All tops shall be sufficiently lopped to insure their being flattened to the ground by an ordinary winter's snow, the lopping to be subject to the approval of the inspector in charge.
11. All merchantable timber used for building skidways shall be cut into logs and hauled out.
12. Timber may be used for booms, but will be scaled and charged at the regular stumpage rates. Hemlock timber, if used for building purposes, shall be charged at the same rate as Spruce.
13. Contractors and lumbermen shall be careful not to do any unnecessary damage to young growth in lumbering.
14. The violation of any of these rules, if persisted in, shall be deemed a sufficient cause for annulling the contract.

INSPECTION.

The work of the inspector is of the greatest importance. Upon his capacity and judgment depends largely the proper lumbering of Township 40, or any other tract. The inspector should combine all the qualities of a first-class lumberman and a competent and impartial scaler, and should have a fair knowledge of practical forestry, besides the necessary energy to insure a careful and thorough inspection of all portions of the tract where lumbering is going on, enforcing the rules as thoroughly in out-of-the-way places as in those open to public scrutiny. He should have full control of the scalers and markers.

Any division of authority in the carrying out of the rules should be carefully avoided. The decision of the inspector should be final upon all matters connected with the lumbering.

He should make detailed reports to his superior officer of the number of pieces and standards scaled on each separate job, and of the general progress of the work at the end of each month. He should also furnish the lumbermen cutting the timber with a statement of the scale of the timber measured at least once a month while scaling is in progress, giving the number and contents of logs of each species.